SCIENTIFIC AMERICAN

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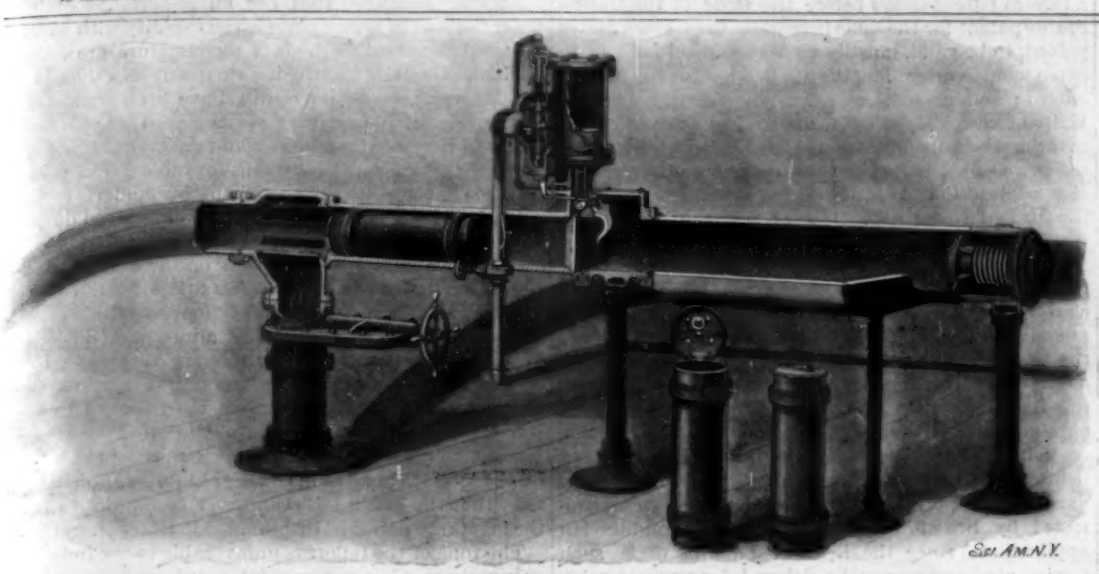

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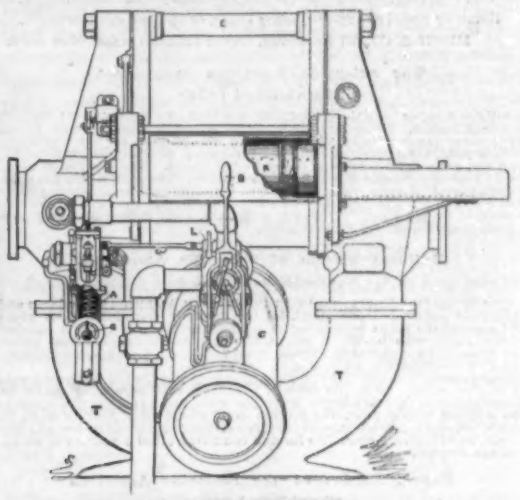

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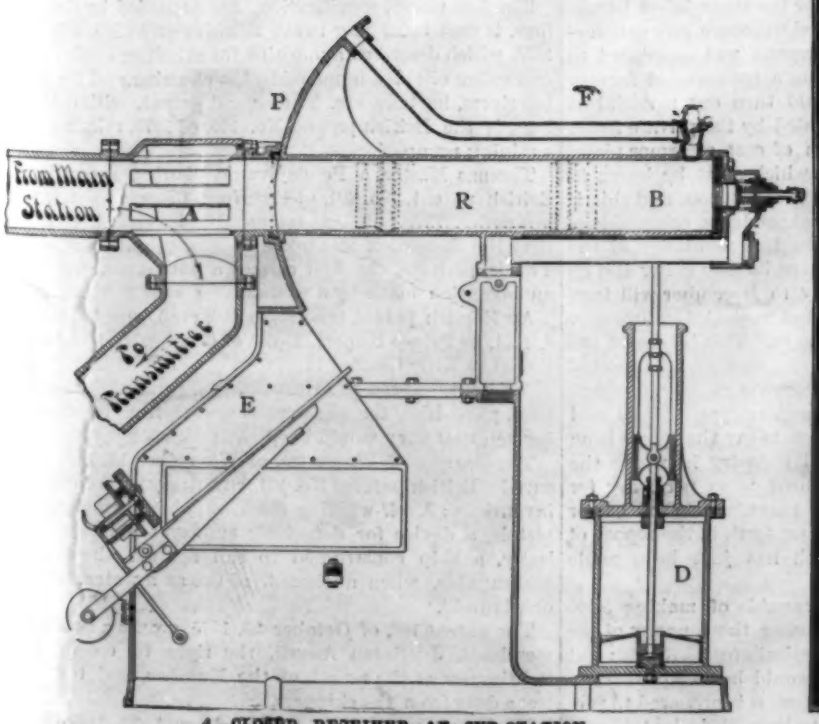

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CHANGES IN UNITED STATES PATENT LAWS.

From notices published in the foreign press concerning the changes in United States patent law that will take effect on January 1, 1898, it is clear that the new conditions created by the amended law are not fully understood abroad. Thus we have seen several statements to the effect that an application for United States patent lodged after January 1, 1898, will be rejected in *all* cases if it is filed more than seven months after the filing of an application for a foreign patent for the same invention. This interpretation of the new law is erroneous. The actual meaning is this: If a foreign patent *issues* before the *issue* of the United States patent for the same invention, the United States patent, to be valid, must have been applied for within seven months after filing the application for the foreign patent; and as soon as a foreign patent issues, the United States Patent Office may reject an application covering the same invention if the United States application was filed more than seven months after the foreign application. It is, therefore, apparent that when the United States patent *issues* first, the interval between the dates of filing is of no moment whatever. Further, a rejection of the United States application under the seven months' clause of the new law can be declared only after the *issue* of a foreign patent for the same invention. Thus it will appear that even when the United States patent is applied for more than seven months after the filing of a foreign patent application relating to the same invention, a valid patent may be obtained in this country, provided the applicant succeeds in securing the issue of the United States patent before that of the foreign patent. This fact will be of particular importance in the case of inventions protected by British, German, Russian or Scandinavian applications, since the issue of patents upon such foreign applications can be delayed for a considerable time if the inventor desires.

The new law changes the requirements for novelty in other respects also, and after January 1, 1898, an application for United States patent may be rejected, inter alia, upon reference to any foreign patent issued (to another inventor) more than two years before the filing of the United States application. Another ground of rejection is the issue of a foreign patent antedating the applicant's invention. In regard to this provision, we would observe that the date of an invention made abroad can be established only by the issue of a foreign patent, or the issue of a printed publication describing the invention, or the communication of the invention (for instance, by letter) to a person residing in the United States.

After January 1, 1898, it will often be of vital importance that an application for United States patent should be filed before the required date. Informalities in application papers are liable to cause a refusal of the Patent Office to accept the application for filing until corrected, and the delay may prove fatal.

THE PROPOSED GOVERNMENT ARMOR PLANT.

The agitation of the question of a government armor plant will at least serve to enlighten Congress and the country at large as to the great cost and many risks and uncertainties involved in the manufacture of armor plate. The proposal that the government should build a plant and make its own armor was the outcome of the recent attempt to reduce and put a fixed limit upon the price that should be paid to private firms. The government had been paying as high as five hundred dollars per ton for armor plate, which, in the opinion of Congress, should be obtainable for between three and four hundred dollars per ton. The attempt to secure bids for the supply of armor for the three latest battleships at the reduced price failed to secure any satisfactory results, and a board of experts was appointed to inquire into the cost of building a government factory and determine whether it could turn out material at less cost than the price demanded by the private firms.

In considering the question of cost of armor plate, there is one fundamental fact which must be borne in mind if we are to reach a just conclusion, and this is that the cost of manufactured products, other things being equal, will depend upon the regularity of the demand. The factory that keeps its fires going and its hands employed from January to December will turn out cheaper work than one that works intermittently, as orders may chance to come in. This is true of the simplest manufactures, and the cost of interrupted and intermittent work will increase rapidly in plants which are expensive to build and employ difficult and costly processes. Now it is safe to say that there is no branch of the iron and steel industry in which the guarantee of steady employment is so necessary for economic results as in the manufacture of armor plate, and this fact is clearly set forth in the report of the armor plate board, which has just been made public.

It is estimated that a plant capable of making 5,000 tons of armor a year, this being the capacity of the existing private plants, could be built for $3,750,000; but the board considers that it would be inexpedient to erect such a plant unless Congress is prepared to provide enough ships each year to keep the plant in constant operation. It is pointed out that an armor factory includes special furnaces, tools and appliances which are not available for any other class of work, and a class of labor specially skilled in the art. Under our present system it is possible that Congress may fail to make any appropriation for a current year. This would involve laying off indefinitely a trained force of men, who would soon scatter in search of other work. When a new appropriation was made it would be necessary to engage men that were ignorant of the process and train them in the use of the special appliances.

Another condition that has an important bearing upon the cost of armor plate is the rapidity with which new and improved methods of manufacture are being devised. Great as was the improvement introduced by the Harvey process, its results have been equaled, if not surpassed, by new processes employed at the Krupp works in Germany and in England; and the rapid progress of the art continually calls for radical and costly changes in the plant. These changes would cost considerably less if they were gradually introduced during the continuous working of the plant than they would if they were carried out hurriedly on the eve of an expected appropriation by Congress and after the plant had lain idle for twelve or twenty-four months.

The estimate for a government armor plant includes provision for building the necessary furnaces for a complete steel plant, for it is considered that the capacity to produce the steel ingots is important to the successful and economic administration of an armor factory. This policy is consistent with the practice of all the largest concerns in the steel industry, which consider that the best results can never be obtained when the ingots are obtained by purchase in the open market.

The tone of the report is unfavorable to the building or purchase of a government plant, and justly so. The facts as above outlined prove that the best policy under existing circumstances is to give a fair price, which will take account of the special risks involved in armor plate manufacture, and encourage private companies to continue in the business. This system has worked to good advantage in Europe, where the armor plate is manufactured almost entirely by private firms. At the same time it is evident that the real difficulty in the whole matter lies in the capricious methods adopted by Congress in the matter of naval appropriations. This could be removed by laying down a plan of naval construction which should extend over a lengthy period, in which a stated appropriation should be asked for each year, the number, style and design of the ships being determined by the requirements and naval developments of each current year. Such a fixed policy in the matter of appropriations would have an excellent effect in any case. If the government wished to build its own armor plant, it could do so with the expectation of running it on an economic basis, gathering within it a corps of skilled experts and workmen, and modifying the plant from time to time to meet the developments of the art. If, on the other hand, the armor were made by private firms, its price would unquestionably be favorably affected by the steady employment which the new policy would guarantee.

SOME CURIOUS OLD PATENTS.

In our German contemporary Glaser's Annalen some interesting particulars are given as to early British patents. It will be seen that the idea, at least, of some of our modern inventions was anticipated by these curious old patents. We give below some interesting examples:

The first patent specification, accompanied by drawings, is that belonging to the British patent No. 169, of 1673, which describes a machine for grinding seeds and extracting oil; also a machine for cleaning and dredging rivers, harbors, etc. The second patent, with drawings, is the British patent No. 186, of 1675, relating to a mining pump.

Thomas Master, a Pennsylvania planter, secured a British patent, No. 401, of 1715, for a process for treating corn. This patent is remarkable in that it states that the invention was made by Mrs. Sibylla Masters. This is, perhaps, the first case of a patent granted for an invention made by a woman.

An English patent (making steel, etc.), granted May 6, 1671, to Prince Rupert, Duke of Cumberland, was assigned to King Charles II.

A patent granted to Prince Rupert, Duke of Cumberland, gave him the right to take oath from his workingmen that they would keep the invention secret.

The Marquis of Worcester, on November 15, 661, secured a British patent, No. 131, covering the following inventions: A self-winding clock, rapid-firing guns and pistols, a device for detaching runaway horses, and, lastly, a ship constructed to sail against the wind and capable, when anchored, of use as a watermotor or windmill.

The patent 183, of October 25, 1675, granted a London merchant, Justinian Angell, the right to erect two lighthouses at the mouth of the Humber, and to collect a duty from the skippers.

By letters patent No. 255, of August 23, 1685, the

Duke of Albemarle secured the sole right of erecting sawmills, driven by wind or by water, in some colonies (excluding New England).

A repeating rifle is described in the patent to Charles Cardiffe, No. 216, of February 16, 1682.

Patent No. 184, of 1675, shows how to convert foul water and salt water into palatable drinking water in large quantities and quickly.

The idea of catching fish by the aid of lamps is found in the patent No. 295, of April 22, 1692.

The first patent for a burglar alarm is the British patent No. 331, of January 11, 1694.

Patent No. 314, of January 31, 1693, covers a process for utilizing the heat generated when slaking lime.

The first English patent containing a mention of coffee is that granted to Richard Bull, No. 373, of December 22, 1704, for a coffee roasting machine.

The first patent containing a reference to potatoes is No. 413, of May 17, 1717, for a process of making starch from potatoes.

A chemical fire extinguisher is described in patent No. 458, of November 12, 1723.

Thomas Savery's patent for his steam engine is numbered 356 and dated July 25, 1698.

A wave motor is described in patent No. 315, of 1693.

The use of the hydraulic jet for the propulsion of vessels is described in the British patent No. 132, of May 16, 1661, granted to Thomas Toogood and James Hayes.

The British patent No. 236, of 1684, granted to John Cliquet, relates to a carriagelike machine adapted for use as a conveyance for one or two persons. The inventor apparently had a motor carriage in view.

The first patent relating to street lighting is that granted in England to Vernatty, No. 227, of 1683.

The first patent relating to street cleaning is a British patent granted February 21, 1674, to Thomas Toogood.

On June 20, 1699, Edmund Heming secured a British patent, No. 364, for a street sweeping machine.

The British patent of Edmund Heming, No. 282, of October 17, 1691, is for the "making of iron plates tinned over, commonly called tinned plates, as good as those brought from and made in Germany." The use of the words "made in Germany" at such an early period is significant.

COSTLY BUTTERFLIES.

BY GEORGE E. WALSH.

The Museum of Natural History, New York, recently obtained one of the finest collections of butterflies in the world, and visitors interested in things beautiful or matters scientific may soon examine at their pleasure and convenience the gaudy wings and plumages of butterflies that have been gathered at the risk of life and health from every quarter of the globe. Owing to the delicate hues and colorings on the wings of some of these giddy creatures, they cannot be exposed to the bright light of the exhibition halls without losing something of their charm and beauty, and they will be mounted and kept in rooms where the light is artificially shaded to suit the exhibits.

The general public gains an insight into the work of the entomologist in viewing this collection of butterflies, especially if such additional information is given which will enliven the subject with popular descriptions of the odd creatures and their habits. One hardly realizes the extent to which collectors have carried their hobby, and how many risks and dangers have been braved in order to capture rare specimens in odd corners of the earth. To make a collection of value to science, the butterflies from all regions of the earth must be represented—those from the jungles of India, from the Cannibal Islands of the South Pacific, and from the cold plateaus of our great northern regions where only a few living forms can exist. One man could hardly capture specimens of all the butterflies in existence, even though he spent a lifetime at the work and lived to be twice threescore and ten. A large collection consequently means the work of dozens or even scores of men scattered throughout the world, but brought together and arranged by one or two enthusiastic entomologists of rare skill and knowledge in identifying and classifying the creatures.

The high prices paid for rare specimens of butterflies has had the effect of inducing dishonest collectors to impose upon the innocent. Recently the entomologist of the London Natural History Museum received an apparently new and beautiful butterfly from India; but upon a microscopical examination it proved to be an ordinary variety, artfully and skillfully dyed. This was the first time that this trick had been performed; but it was getting to be quite an old story at the museum to receive consignments of butterflies of a composite nature; that is, the wings of several different species would be removed and composite butterflies of unique appearance would then be manufactured from them.

There are a number of wealthy entomologists in England who own private collections of butterflies valued all the way from $100,000 to $150,000. The most costly, and probably the most perfect, collection in the world, private or public, is owned by the Hon. Walter Rothschild and is kept in his private museum of Tring, in Hertfordshire. The collection has probably cost its owner several hundred thousand dollars—the exact sum can only be guessed at. It is the accession of these wealthy collectors to the ranks of the professional entomologists that makes it possible for butterfly hunters to secure the high prices that rare specimens command to-day. There is no regular table or set list of prices; but it may be said in a general way that they vary from a few cents apiece for common insects up to one hundred or more dollars for very rare creatures. The African Papilio antimachus, a very rare butterfly, is quoted high in the London market, and a beautiful pair recently sold for $130 at auction. New Guinea butterflies were exceedingly high priced a few years ago, and some of them brought as much as $250 apiece; but to-day they are more plentiful and sell at about half this price. Papilio caunus, one of the mimic butterflies, will generally bring $50 in the market to-day. When the hunters first began to penetrate into the wilds of the unexplored regions of the earth for butterflies, exorbitant prices were offered for the few rare specimens brought back. The wealthy collectors then paid prices that were out of all proportion to the real value of the insects, report having it that an American collector offered $1,000 for a single rare specimen, and one of the Rothschilds paid half this sum for a Papilio that is quite common to-day.

In the Denton collection, recently placed on view in this city at the American Art Galleries, there were 1,300 varieties represented, and their value has been variously estimated at $10,000 to $30,000. Most of the specimens were caught and mounted by the two owners of the collection, William and Skelly W. Denton; but others were gathered by private hunters in different parts of the earth, or purchased outright in the London market. There are several London firms engaged in butterfly collecting, and most of the rare specimens find their way, sooner or later, to them. They have traveling entomologists in every part of the earth who collect for them such specimens as they need. These authorized agents for the firms are supplemented by free lances and general collectors of everything queer and unique that can be found in the out-of-way corners of the earth. They unite butterfly collecting to orchid and lizard hunting in such a way that they are pretty sure of good rewards. They go forth into the great tropical woods and swamps armed with three sets of hunting implements; one is for gathering orchids, another for shooting wild beasts and human enemies, and a third for corraling and preserving rare butterflies.

The latter work is not the least interesting of the three and one that is probably known the least about. The hunters carry with them all the modern outfits necessary to preserve the butterflies in a perfect state; but in many cases they fail to secure their booty entire. So delicate are many of the filmy wings and legs that it is rare to find more than ten per cent of the hunter's collection in a perfect condition when he finally reaches civilization. There are rare butterflies of tropical Africa and America which are found in several large collections; but not a single specimen has ever yet been perfectly mounted.

The butterflies are collected in two ways: they are either caught in a net or in the larval or chrysalid form. Those captured in the latter condition can be developed into perfect specimens in captivity; but hunters in the wild swamps and jungles do not have the facilities for transporting the larvæ to civilization, and they rarely attempt to bring back specimens in this condition. They depend entirely upon the net for capturing them. The net is mounted on a jointed pole, so that the entomologist can make a sweep ten feet or more up in the air. When the insects are caught they are dropped into a bottle of cyanide, which quickly and painlessly kills them.

The common butterflies which we see flitting about in our gardens and fields may be easy enough to capture, but in the tropics the rare specimens frequently flutter among the treetops where the beautiful orchids and trailing vines bloom. In order to capture them it is consequently necessary to climb the trees and take up a precarious and uncertain position among the branches, fifty or a hundred feet high. Then when the butterflies hover near the tree a skillful sweep of the net may imprison one or two. There are some odd varieties which refuse to be captured even in this difficult manner, and decoys have to be set for them. Curiosity seems to be born in butterflies as well as in human beings, and some varieties have a great predilection for rich and unusual colors. Thus a red, blue, or white piece of cloth tied among the trees will sometimes attract the wild insects, and they will exhibit curiosity to approach close enough to the object to satisfy the hunter. Mounted specimens of butterflies pinned in conspicuous places have been known to attract others of a like nature. Sweets will also bring the butterflies swarming around a given point. Molasses mixed with rum, spread upon tree trunks, has been the means of capturing rare specimens. The insects would eat of the sweet mixture, and then apparently lose their heads under the effects of the liquor and permit themselves to be caught in the hunter's net.

When the butterflies are killed with the cyanide they are laid carefully in the collecting box, or folded in a paper cocked hat prepared for the purpose. When properly folded a great number can be carried in a small box in this way. When taken back to camp, or upon reaching civilization, the dried mummies are placed in a relaxing box. This is a small wooden receptacle lined with damp flannel. They are kept in the relaxing box for about twelve hours, during which time they absorb the moisture from the flannel like a sponge. The dried, mummified bodies, wings, and legs then gradually swell out and assume their normal appearance. They become so soft and limp that any rough handling would soon destroy them. The operator picks them up with a tiny pair of forceps, and pins them on cork-covered boards and arranges their wings in a lifelike attitude. The wings are usually spread out at right angles to the body, so that one can get a perfect view of their colorings. In this position they are allowed to remain for a week or more until thoroughly dried. Then they are arranged and classified, and properly remounted with appropriate surroundings.

THE DIETARY OF CYCLISTS.

Dr. Lucas-Championniere, of Paris, who has devoted a good deal of attention to the medical aspects of cycling, expresses his opinion that 600 kilometers in twenty hours, the time in the Paris-Bordeaux contest, was not too much for a healthy and well trained rider. Dr. Championniere gives the following details of Rivierre and Cordang's methods during the Bordeaux-Paris race:

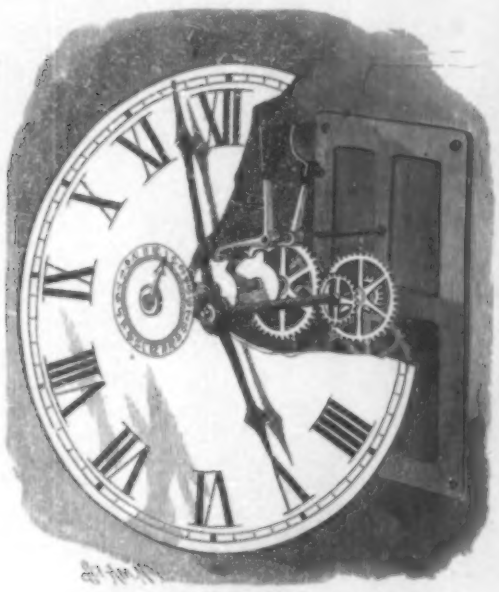
"They did not eat nitrogenous food, and they were right. But though they did not eat, they drank enormous quantities of liquid to replace the liquid or weight lost by perspiration. They drank tea, beef tea and milk. It is useless to eat during violent exercise, but it is important to drink, and if the body is in good working order, the only result of the effort is a decrease in weight. The effect on animals is similar. M. Paillard, the sportsman, who rode 1,200 kilometers in sixteen days last year on his two mares Pomponne and Merveilleuse, did not increase their ration of oats, but gave them large quantities of green fodder and water. It is the same with our cyclists, who race on fruit and a deal of liquid." This is right as regards the quality of food required on a long distance contest. Whether such a race be harmful to an exceptional rider, properly trained or not, we do not yet know. Mills, Shorland, Holbein, Bidlake, among English, and Rivierre, Huret, Stephane, Dubois, among French riders, with many others who have frequently competed in such races, are still well and healthy, including D. Stanton, who raced about 1874 and 1875 in six day races. We must watch their careers in future before we can lay down any rule. Our own opinion is that it does no harm to the one man of exceptional physique, but is most harmful to the many who are improperly trained.—British Medical Journal.

INVOLUNTARY MOVEMENTS AS CONTROLLED BY IDEAS.

This subject, which has already received considerable attention, has been investigated further by M. A. Tucker, of Stanford University, who describes his experiments in The American Journal of Psychology. According to a brief abstract in The American Naturalist, "the object of Mr. Tucker's investigation was to determine, first, any general tendencies to motion in the hand, apart from the spatial influence of thought; and second, the comparative value of these involuntary movements in adults and children. The apparatus used was similar in its essential features to Jastrow's automatograph. To prevent the attention taking a directional character, in the experiments where this was to be avoided, the subject recited the multiplication table, conjugated French verbs, etc. As regards the first point of investigation, there was found to be a 'tendency for the hands and arms resting in front of the body to move inward toward the median plane of the body.' There did not appear to be any necessary tendency for the hands to move toward a visible object to which the attention was directed, if that object was thought of simply as at rest; but the sight of moving objects, or the remembrance of them, caused an involuntary imitation of the direction of the moving stimuli, not only by the hands, but also by the whole body; this tendency manifested itself in a distinctly observable swaying of the head. As to the second point, the investigation brought out the general fact that 'children are governed by and subject to the same laws as adults, but to a less extent.' Individual variations were wider in them than in adults. No differences were found in children due to age or sex. These experiments seem to substantiate the views of Féré and Lehmann while they disagree with those of Jastrow, who reported a tendency of the hands to move toward stationary objects whenever the attention was directed toward their locality."

AN AUTOMATIC ELECTRIC TIME SWITCH.

The illustration represents a switch designed for use on any kind of electric circuits to open or close them at any desired time of the day or night. It has comparatively few parts, and is designed to work with but little friction, thus assuring accuracy and quickness of action. It has been patented by Addison B. Williams, and is being manufactured by the Williams Electric Time Switch Company, of Waco, Texas. The illustration shows the improvement behind the broken-away portion of a clock dial, on which is a setting scale, and to set the switch it is only necessary to turn the small finger piece until the pointer is opposite the point desired.



WILLIAMS' ELECTRIC TIME SWITCH.

The switch comprises rocking levers carrying contact plates, insulated from the levers, the plates being movable from each other without rubbing action. A cam governs each lever, the two cams being of like construction. To adjust the length of time for the burning of the lamps, one cam is adjusted relatively to the other by holding the pointer on the setting scale and turning the sleeve on which such pointer is mounted, the sleeve also carrying one of the cams, until the proper time is reached. The time switch automatically turns the lights on and off for the desired prearranged periods of time. The improvement is also designed to be especially advantageous for electric light supply stations, which may thus be enabled to furnish arc lights by the hour from the regular all night circuit, the switch being in this respect a time meter.

Distance Gas Lighting Devices.

On this "burning" question, since the general introduction of incandescent gas light, Engineer Von Morstein spoke, the other day, at a session of the Society for the Advancement of Industry, in Berlin. The lecturer reviewed, with the aid of numerous sketches and working models, the various systems and constructions, arranged in groups, which have been devised for the purpose of a convenient and safe ignition of gas flames. First of all, he mentioned the system consisting of continually burning small flames, which ignite the main flame when the latter is turned on. These, of course, cause a steady consumption of gas. Next in line were the automatic gas lighting contrivances, which are constructed on the old principle of Döbereiner's platinum match box. A platinum sponge is rendered glowing by the outflowing gas, which, in its turn, ignites the gas by means of a thin platinum wire; but in order to insure the preservation of the igniting composition for a reasonable length of time, a complicated apparatus of valves, etc., becomes necessary. The last style of gas lighting devices are the electric ones, which utilize the various qualities of the electric current for igniting purposes. With the first group a fine platinum wire is caused to glow by the electric current, but it is destroyed in a short time. Ignition can also be effected by two pole wires of an electric battery scratching together. Several devices are based upon this principle, mostly for distance gas lighting, as they make it possible to ignite the gas from any place, the gas cock opening and closing electromagnetically. This method, however, only admits of igniting or extinguishing one flame at a time. The latest contrivance, which the lecturer considers the best one, is the multiplex gas lighting device constructed by him, which is sold in Germany by the German Incandescent Gas Light Company (patent Auer). The underlying principle is widely different from that upon which all former electric igniting devices are based. The battery currents are converted into induction currents of high tension, which easily overcome all resistance, and breaking through the air, in the shape of sparks, ignite the gas. The generation of these currents is brought about in a most simple and ingenious manner, and their uses are quite numerous; thus several eight-flame chandeliers in the lecturing hall were lighted and extinguished all at once; likewise staircase lights, show window foot lights, etc., were simultaneously ignited. The multiplex and distance gas lighting devices have now been in use for about one year and have given great satisfaction.—From the Zeitschrift fuer Beleuchtungswesen.

Artificial Black Marble.*

A new discovery has been made by a Calabria engineer—the manufacture of artificial black marble; and this industry is now being carried on here in Catania by the firm Tortorici & Grasso, who are the owners of the gas works and manufacture various by-products. The artificial marble has been patented in Italy and other countries. It can be made into any form desired, and fully takes the place of black marble, resembling it so closely that it is difficult to distinguish it from the real article, while its cost is said to be very much less.

The process is said to be as follows: Common white sandstone is first cut into the desired shapes; then the various pieces are placed in a large, square iron tank, upon a heavy wire grating, the latter resting a few inches above the bottom of the tank, in order to keep the stone from touching the bottom and to permit the fluid to penetrate freely everywhere; the stones must not touch each other. Then, through an iron pipe, a molten mass of volcanic asphalt and coal tar pitch, mixed, I believe, in equal parts, is let into the tank from an adjoining boiler until the molten mass fully covers the pieces of sandstone. This liquid is kept boiling in the tank for thirty-six hours; then the stones are taken out, placed upon a brick floor to cool off and dry, and are afterward polished in the same manner as other marble.

The artificial product is said to resist acids, is not damaged by atmospheric action, moisture, heat or cold, and is claimed to be aseptic.

In the same manner the firm also prepares pressed tilings for flooring, roofing, etc., which are said to be perfectly watertight and aseptic.

I am told that a mass of sand, cement and water, after having been thoroughly kneaded, is put into forms, put under a press, which works quite rapidly, taken out and dried awhile, and then placed in the tank boiler for thirty-six hours, as in the manufacture of the artificial black marble, and, after being cooled off, is placed in a rotary grinding or polishing machine. This machine consists of a large, round, stationary grindstone, upon which revolves an iron frame, with partitions therein for holding the tiles in place.

AN IMPROVED DOUBLE GRINDING MILL.

A double grinding mill presenting some novel features, grinding the same feed through two mills on the same spindle, where the grinding pressures balance each other, is represented in the accompanying illustrations. The mill is adapted for grinding corn and cobs, feed and table meal, the grain passing through the first mill into a screw conveyor and being carried past both mills and emptied into the back mill, where it is ground the second time and discharged onto the floor or into the elevating sacker. This mill has been but recently introduced by Messrs. A. W. Straub & Company, of No. 3737–41 Filbert Street, Philadelphia, Pa. One of the illustrations shows the top half of the mill laid open to change the disks, an extra spindle with all the parts separated being laid in front. A center partition divides the two grinding cases. The tramming ring and all parts in the first mill are the same as in the single mills heretofore made by this firm, but the second mill has its tramming ring hung like a mariner's compass, in a meal-proof case, with a bridge tree behind, to set it up by means of two temper screws, thus causing the mills to grind either coarse or fine. Both mills being on the same shaft, the grinding pressure of one is directly against the other, doing away with the friction on the end of spindle, and effecting a very considerable saving of power, as well as reducing the wear of parts. The mill grinds as fine passing once through the mill as to run it through the old mills twice. It balances perfectly, runs light, does not choke or heat the shaft or boxes, and the ground feed comes from the mill nice and cool. The mill is claimed to do one-half more work than single mills with the same power.

* United States Consular Reports. Louis H. Brühl, consul, Catania.

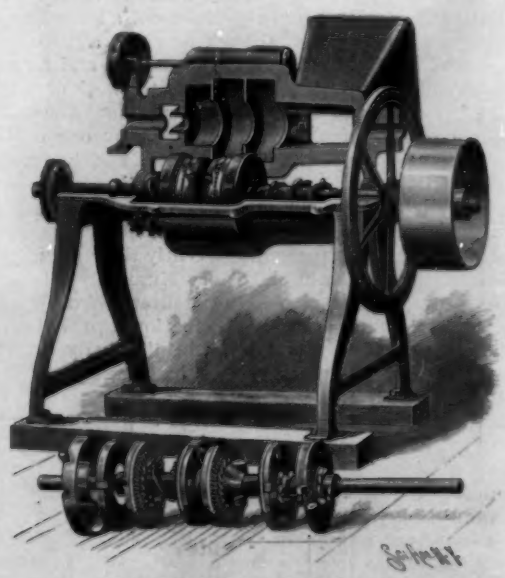
A PUMP FOR PNEUMATIC TIRES.

A bicycle tire pump adapted to be operated by the movement of the wheel, and which may be thrown into and out of gear at the will of the rider, is shown in the accompanying illustration, and has been patented by Alanson S. Simpson, of Folsom, New Mexico. Fig. 1 represents the application of the improvement to the front wheel of a bicycle, the axle being held in the fork of the frame and the hub turning loosely on the axle. A plate made fast to and running radially from the hub carries a cylinder, which is also lashed to the spokes, and from the cylinder a tube leads to the wheel tire. Arranged loosely on the axle is an eccentric in whose outer face is an inclined way at one end of which is a lug having two recesses, and rocking in bearings carried by one arm of the fork is a rod or shaft on whose lower end is a fixed two-fingered dog adapted to engage and disengage with and from the lug. When the dog is engaged with the lug the eccentric is fixed to the fork, and when it is disengaged the

SIMPSON'S PUMP FOR PNEUMATIC TIRES.

eccentric turns idly around with the wheel. The upper end of the rod has a latch, which, in connection with a ratchet plate on the fork, serves to hold the rod in either of its two positions. An eccentric strap mounted with antifriction balls on the periphery of the eccentric, as indicated in Fig. 2, is connected with a piston rod, arranged to operate a piston in the cylinder, thus forming an air pump to be operated at pleasure when the wheel is in motion by simply moving the latch on one arm of the fork. When the dog on the lower end of the rod and the lug on the eccentric are disengaged, the wheel in turning carries the cylinder around with it, and the eccentric and eccentric strap play idly around the axle, the piston not being operated and the device being inactive.

MILL READY FOR WORK.

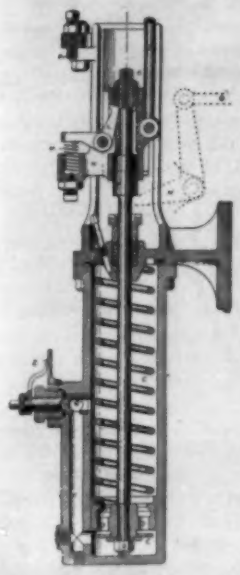


TOP HALF OF MILL OPEN TO CHANGE DISKS.

STRAUB'S DOUBLE QUAKER CITY GRAIN MILL.

PNEUMATIC MAIL TUBE SYSTEM, NEW YORK CITY.

The transmission of matter through closed tubes by means of a current of air flowing therein is not by any means a novel idea, although its successful application to commercial purposes is of recent date. For the earliest suggestion of pneumatic transmission we must go back to the seventeenth century and search among the records of that venerable institution, the Royal Society of London. Here we find that Denis Papin presented to the society in the year 1667 a paper entitled the "Double Pneumatic Pump." He exhausted the air from a long metal tube, in which was a traveling piston which drew after it a carriage attached to it by means of a cord. At the close of the eighteenth century a certain M. Van Estin propelled a hollow ball containing a package through a tube several hundred feet long by means of a blast of air; the device, however, was regarded more as a toy than a useful invention. Of more practical value were the plans of Medhurst, a London engineer, who published pamphlets in 1810 and 1812 and again in 1832, when he proposed to connect a carriage running inside the tube with a passenger carriage running above it.



6.—TIME LOCK FOR TRANSMITTER.

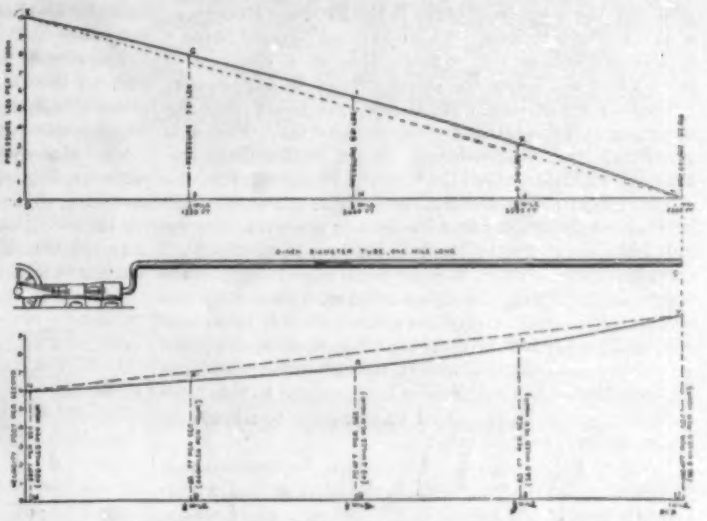
The distinction of being the first city to install a practical pneumatic tube system belongs to London, where in 1853 a 1½ inch tube was laid between Founders' Court and the Stock Exchange, a distance of 220 yards. The carrier was drawn through the tube by creating a vacuum, a steam pump being used for the purpose. The roughness of the interior of the iron tubes gave much trouble, and when subsequent extensions of the system were made in 1858 and later, 2¼ inch lead tubes were used, the carriers being made of gutta percha with an outer lining of felt.

In 1865, Siemens & Halske, of Berlin, laid down in that city a system of pneumatic tubes for the transmission of telegraph messages. The wrought iron tubes, 2¼ inches in diameter, were in duplicate, one being used for transmitting and the other for receiving messages. They ran from the telegraph station to the Exchange, a distance of 5,670 feet. The tubes were looped together at the Exchange and a continuous flow of air was maintained by a compressor at one end and an exhauster at the other. The modified system now in use is worked by means of large storage tanks, containing either compressed or rarefied air, and it comprises 38 stations and more than 28 miles of tubing 2·55 inches in diameter.

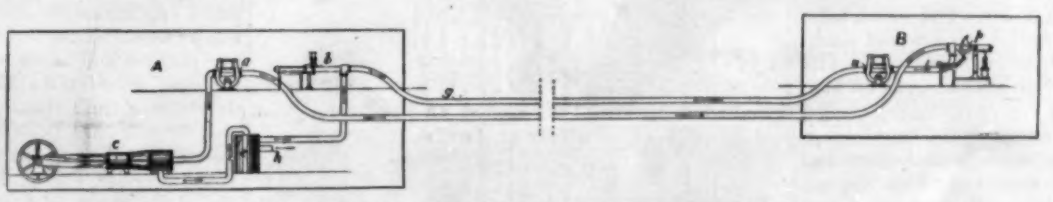
The pneumatic tube system in Paris dates from the same year as that of Berlin. Here a novel feature was introduced in the method of compressing the air, for instead of using a steam engine it was compressed in tanks by displacement with water from the city mains. The tubes of the present system are 2·55 inches diameter, and the carriers are made up in trains of from 6 to 10, with a leather-covered piston at the rear, which fits the tubes snugly and drives them forward. The tubes are of wrought iron and the speed is 15 to 28 miles an hour.

9.—THE BEACH AUTOMATIC POSTAL DELIVERY BOX.

The father of the pneumatic tube system of railways in America was the late Alfred Ely Beach, who for half a century was one of the proprietors of the SCIENTIFIC AMERICAN. His experimental railway was first exhibited at the American Institute Fair held in New York City in 1867. A car capable of seating ten people ran upon a track laid down within a circular wooden tube, which was six feet in diameter and one hundred and seven feet long. The current of air was furnished by a 10 foot helix fan running at 200 revolutions per minute. He then constructed at his own expense an eight foot tunnel, which extended beneath Broadway from the corner of Warren Street to the south side of Murray Street, a distance of 200 feet. The car was propelled by a powerful rotary blower in the basement of an adjoining building, and the car was driven in alternate directions by reversing the valves of the blower. The tunnel is still in existence. Less known but equally meritorious was the system of pneumatic postal tubes designed by Mr. Beach at about the same period. We present two illustrations, Figs. 9 and 10, which were made many years ago under his own direct supervision and need but little description. The letters and packages were to be delivered to cars from revolving hoppers, whose revolution was effected by pins on the edges of the cars striking the vanes. Delivery was effected by tripping the hinged bottom of the car, this also being done by a striking pin. In 1870, also, he built an 8 inch iron tube a thousand feet long, whose interior was glazed to form a smooth surface. This led to a large receiving box, from which a second pipe led to an exhausting engine. A letter dropped into the pipe at any point was swept along by suction due to the exhaustion of the air from the box, and on reaching the box it fell to the bottom, from which it was easily removed.

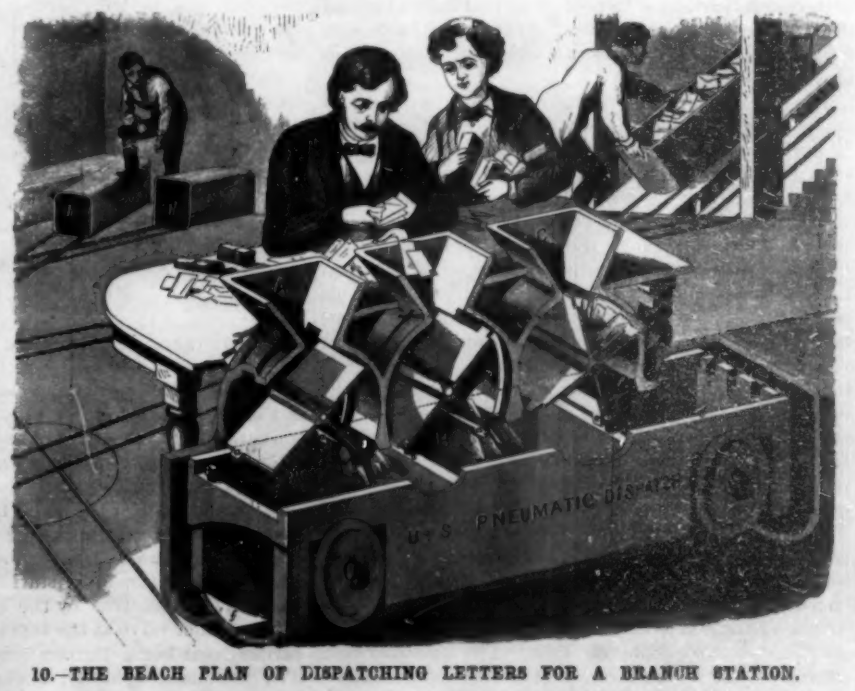


7.—DIAGRAM SHOWING PRESSURE AND VELOCITY CURVES OF AIR IN TUBE.



8.—DIAGRAM OF TWO-STATION ONE-COMPRESSOR LINE.

The London system has grown steadily and now includes 42 stations and 34 miles of tubes. The latter are of cast iron and lined with lead. On the shorter lines the inside diameter is 2⅞ inches, and on the longer lines 3 inches. The lines are laid out radially, air being compressed at one end and exhausted at the other. Similar systems are used in connection with the telegraph service in Liverpool, Manchester, Birmingham, Glasgow, Dublin and Newcastle. Mention should be made here of the underground pneumatic railways constructed in London, the first built in 1863, 1,800 feet in length and 2 feet 8 inches by 2 feet 8 inches in section; the later tunnels, built in 1872, running from Euston Station to the general post office, a distance of 2¾ miles. The latter was in duplicate and D-shaped in section, measuring 4½ feet wide by 4 feet high, the straight portion being of cast iron and the bends of brick. It was operated by a fan, which forced air into one tunnel and exhausted it from the other. The capacity of the line was about one ton per minute. It was not satisfactory and was ultimately abandoned.



10.—THE BEACH PLAN OF DISPATCHING LETTERS FOR A BRANCH STATION.

The pneumatic tube has been in use in this country on a small scale for a quarter of a century for the transmission of cash in retail stores and for general telegraphic purposes. The Western Union Telegraph Company laid down four lines in 1876 from the main office in Broadway, New York—two to the branch office at 14 Broad Street, one to Pearl Street, and one to the Cotton Exchange. To these it has since added two miles of double line which run beneath Broadway to its uptown office.

The most notable event in the recent history of pneumatic transmission occurred in Philadelphia, when a system of 6 inch tubes was built between the main post office and the sub-post office on Chestnut Street, near Third Street, a distance of 3,000 feet. The reader will observe that in all the European systems none of the tubes are larger than 3 inches in diameter, so that in respect of size alone the Philadelphia plant marked a bold advance upon any existing system, the area of the tubes being increased more than four-fold, and the capacity of the carriers in proportion. The speed, moreover, was nearly doubled, and hence, with the improved mechanical appliances for transmitting and receiving, the capacity of each tube cannot be less than twenty times as great as that in the old country systems. The Philadelphia plant was opened in 1893 and has been in successful operation ever since.

In 1897 the Tubular Dispatch Company, of New York, was authorized to construct a system of postal delivery tubes between the general post office and certain sub-stations in New York City. It was decided to adopt the system already in successful operation in Philadelphia, and to this end the Batcheller Pneumatic Tube Company, of Philadelphia, drew up plans for a set of lines running from the general post office to the Produce Exchange, to the Forty-second Street depot, to One Hundred and Twenty-fifth Street, and across the Brooklyn Bridge to Brooklyn. The line to the Produce Exchange and return was built, and the opening took place on October 7 of this year. The Forty-second Street line is approaching completion,

and it is expected that the others will be commenced at an early date.

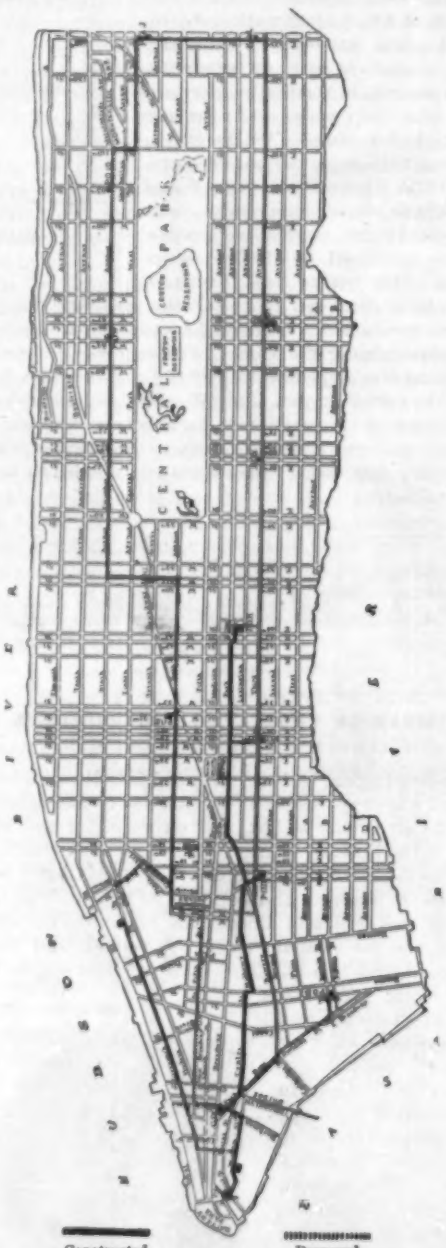
Encouraged by the success of the large tubes adopted on the Philadelphia line, the company determined to make the New York tubes two inches larger, or eight inches in diameter, and to maintain a regular working speed of 30 miles an hour under a headway of 12½ seconds. The capacity of the tubes is thus increased to from 40 to 50 times that of the largest of the tubes in use on the European lines. The two-station branch already completed extends from the general post office to a sub-post office at the Produce Exchange, a distance of 3,750 feet. There are two parallel tubes 8 inches in diameter laid side by side at a distance of from 3 to 8 feet below the street surface. They are connected by a loop at the Exchange, one being used for outgoing and the other for returning mail. Power is furnished by a compressor, C, Fig. 8, at the main station, A, which delivers air at 7 pounds pressure to the square inch to the outgoing tube. The air flows with an increasing velocity and decreasing pressure (the result of its elasticity) to the sub-station, B, at the Produce Exchange, where its pressure is about 3¾ pounds to the inch. From the sub-station it returns by the second tube, as shown by the arrows, to the main station and passes into a receiving tank, E, at which point its pressure has fallen about to that of the atmosphere. The suction of the compressor is connected to this tank and the air is thus caused to circulate continuously through the circuit of tubes.

In order to make use of the current for transmission purposes, a light cylindrical metal shell called a carrier is placed in the tube. It is fitted with two packing rings which prevent the passage of air and cause it to move forward in the tube at the same speed as the current. As the current of air is never interrupted from the time the compressors start in the morning until they are shut down at night, it was necessary to devise some apparatus by which the carriers could be placed in the tubes or removed from them at the start or finish of their journey without interrupting the flow of air. This is accomplished by a transmitter, a, Fig. 8, and a receiver, b, at the main station and another transmitter, n, and receiver, p, at the sub-station.

The straight tubes are made of cast iron, carefully bored and reamed to a smooth finish. The bends, none of which are less than 8 foot radius, are made of seamless brass tubing, 8¾ inches internal diameter. The carriers are made of a plate of sheet steel, $\frac{1}{12}$ of an inch in thickness, which is rolled into a cylinder, riveted and soldered. The front cover is dished to receive a filling of felt, which is covered with thick leather and forms a buffer to cushion the shocks to which the carrier is liable. The shell is 7 inches diameter by 2 feet long and it is kept from direct contact with the tubes by two bearing rings, one near each end, made of a fibrous woven material. These act as packing and afford a satisfactory sliding contact with the tubes. Their life is limited to about 1,000 miles. The carrier is closed by a hinged cover at the rear, which is locked by three radial bolts. The latter are driven into three holes in the shell by means of a rotating latch operating a cam attached to the cover. The cam is placed eccentrically on the cover, and when the latch is in place locking the bolts it clears the edge of the carrier. As the throwing over of the latch in unlocking the bolts causes the former to project several inches beyond the cover and in contact with the tubes, it will be seen that the carrier cannot become unlocked while it is in transit.

The carrier is introduced into the tube by means of transmitters, a, n, Figs. 2 and 8. The transmitter can best be described by supposing that a section long enough to inclose a carrier were sawed out of the main tube and hung from an overhead shaft, E, Fig. 2, parallel to the tube, in such a way that it could be swung away from the main tube to receive the carrier, and then swung back into line where the current of air could act upon the carrier and force it into the main tube. The ends of the movable section are planed and finished off perfectly smooth and square, so that no air can escape at the joints. When the movable section is swung out of line, two laterally projecting plates move across the ends of the main tube and prevent the escape of air, the current meanwhile traveling round the opening by means of a by-pass. The movements of the swinging section are controlled by an inclined pneumatic cylinder, C, whose valve is operated by a small hand lever, B. In the normal position, when the transmitter is not in use, the movable tube is drawn over opposite a loading tray, and the current passes through the U-shaped by-pass, T, which forms the legs of the carrier. When a carrier is to be sent it is placed on the tray and pushed into the swinging tube. The operator then pulls over the hand lever, B, thereby compressing a spring, which serves to push over the slide valve that operates the pneumatic cylinder. The slide valve may be prevented from moving, however, by a time lock, A, which releases the former twelve and one-half seconds after a carrier has been dispatched. The time lock (which insures a proper headway between successive carriers in the tube) is shown to the left of the pneumatic cylinder in Fig. 2 and in larger detail in Fig. 6. It consists of an oil cylinder, C, in which is a piston that is normally kept at the bottom of its stroke by a coiled spring. When the starting lever is pulled over, the time lock piston is drawn up against the spring, which at once begins to force the piston back, driving the oil around a by-pass valve, G, the time of its descent being regulated by the degree to which G is opened. At the bottom of its stroke an offset on the piston rod, J, pulls down a bell crank, N, which, by means of a connecting rod, O, withdraws the locking bolt, L, on the valve of the pneumatic cylinder and permits the latter to throw the transmitter into line.

The carrier is impelled into the main tube and carried to the sub-station. As the air pressure at this point is 3¾ pounds to the square inch, it is impossible to open the tube for the purpose of removing the carriers. Moreover, as they arrive at a speed of 30 miles an hour, some provision has to be made for gradually checking their speed. These two results are obtained by means of the closed receiver, Fig. 4, which consists, like the transmitter already described, of a movable section of 8 inch tube. It is about double the length



11.—PRESENT AND PROPOSED POSTAL TUBE LINES IN NEW YORK CITY.

of a carrier, and is hung upon trunnions in much the same way as a telescope, the trunnions being placed midway of its length. In its normal position, as shown in Fig. 4, it forms a continuation of the tube by which the carrier arrives, and as the latter is impelled into the receiver, it compresses the air in front of it and is brought to rest without any harmful shock. Just in front of the receiver the main tube is provided with a number of slots, A, which by-pass the air into a tube which leads through the sub-station transmitter, n, Fig. 8, back to the main station. The compression of the air in the receiver by the entrance of the carrier opens a relief valve at the rear end, and so prevents the carrier from being thrown back into the main tube. The pneumatic cylinder, D, elevates the outer end of the receiver and tilts the latter on its trunnions, for the purpose of discharging the carrier on to the receiving table. This is accomplished automatically as follows: A small portion of the air compressed in the receiving chamber flows through a small pipe to a piston which controls the slide-valve of the tilting cylinder, D. The piston pushes down the piston slide-valve and admits air to cylinder, D, whose piston rises and by means of a connecting rod tilts the receiving chamber to an angle of 40 degrees. The carrier slides out an inclined and pivoted platform, E, which is kept in the inclined position by a counterweight. The weight of the carrier overbalancing the counterweight, the platform falls to a horizontal position and delivers the carrier onto a table in front of the operator, as shown in Fig. 5. An ingenious arrangement of bell cranks and rods connects the platform, E, with the slide valve of cylinder, D, so that the return of the former to the inclined position causes the cylinder to return the receiving chamber, B, to its normal horizontal position ready to receive the next carrier. Above the front end of the receiving chamber is a plate, P, carefully turned to the radius of the arc described by the chamber on its trunnions, which closes the end of the main tube when the chamber is in the tilted position. The interval from the arrival of a carrier to the return of the receiving chamber to the horizontal position is only 3 or 4 seconds.

The transmitter, n, at the sub-station is similar to that at the main station, already described. The receiver at the main station, however, is entirely different from the one just described. Its construction is shown in detail in Fig. 1. The carrier arrives by the curved tube and passes into a receiving chamber, which is simply a section of tube closed by a vertical sluice gate. The current of air, now expanded to atmospheric pressure, passes from the main tube down a vertical pipe to the return tank, e, Fig. 8, in the basement. The distance from the slots through which the air passes to the tank, to the sluice gate, is about 4 feet, and the momentum of the carrier is absorbed in compressing the air ahead of the car as it enters this chamber. Part of this compressed air passes up through a small pipe, as indicated by arrows in Fig. 1, and enters a small cylinder, where it depresses a piston which is normally held at the top of its cylinder by a coiled spring. This cylinder is situated just above the piston slide-valve of a pneumatic cylinder, whose work is to raise and lower the sluice gate above mentioned. The depression of the small piston and the attached piston valve admits air at 7 pounds pressure below the piston of the pneumatic cylinder and raises the sluice gate, to which it is attached. The very slight pressure of the air behind the carrier is sufficient to force it out onto the receiving table. As the carrier passes out it strikes a small trip-finger, which moves the piston slide-valve back to normal position and shuts the gate. If the air pressure in the main tube is not sufficient to expel the carrier from the receiver, the vertical pipe that conducts the air current to the return tank is partially closed by means of the gate valve shown in Fig. 1.

The diagram, Fig. 11, is inserted to show the principles of the system of pneumatic transmission above described. Air at say 10 pounds pressure is supposed to be constantly supplied at one end of an 8 inch tube one mile in length, the pressure falling until it leaves the other end at zero. The air being elastic it expands as it flows, and this expansion necessarily increases its velocity. The decrease in pressure and the increase in velocity are shown respectively by the curved lines in the upper and lower diagrams.

The accompanying map of a part of New York City shows the present and proposed lines of tubes contemplated by the Tubular Dispatch Company. The full black line indicates the lines already either completed or practically completed, and the dotted lines mark the proposed extensions.

For the drawings and data used in our description of this extremely interesting plant we are indebted to Mr. B. C. Batcheller, chief engineer of the Pneumatic Tube Company, who is the inventor of the salient features of the system.

A Word to Mail Subscribers.

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Science Notes.

Salts of cinnamic acid have been used as a remedy for tuberculosis on four hundred patients of Prof. Landerer, of Stuttgart. From an experience of seven years he hopes that he has found a lasting cure for the disease.

A novel use of the kinematograph is reported from Germany, where the instrument was recently used to secure a series of pictures representing all the movements of the hull made during the launching of a vessel. The instrument selected for the purpose was the Messter-Betz biograph, said to be capable of recording four thousand impressions a minute. The German naval officials are said to take considerable interest in the experiment, and no doubt it is capable of useful extension.

According to a writer in Les Nouveaux Remèdes, black eggs are not uncommon from ducks, who are extremely found of acorns. The coloring matter of their egg-shells is rich in iron. The resulting combination of tannin and iron is stated to result in black eggs. According to the same authority, bright red eggs may be obtained from fowls by feeding them with lobster shells (presumably boiled). We cannot state the original source of these statements, but they bear obvious evidence of transatlantic origin.

The tremendous force of the sea was illustrated by an object lesson ashore in New York City recently, when five large tanks, built to contain 120,000 pounds of soap, but which were temporarily filled with water and situated on the fourth floor of a large building on West Fifty-second Street, collapsed, and completely wrecked the whole building, killing three men and doing a large amount of damage. The tanks were each 15 feet high and about 13 feet diameter, and contained 161,703 pounds of water, but the floors and supporting beams proved altogether inadequate to stand the strain. A wave of the dimensions of one of these tanks is not at all unusual at sea, and when such a wave breaks on a vessel's deck the force of the blow can only be estimated by the amount of damage it does, in spite of the elasticity of the water beneath the vessel to ease her in receiving the shock.

The London Times prints the following dispatches received from its correspondent at Melbourne, October 3: "The scientific expedition which was dispatched to the Ellice Islands by the Sydney Geographical Society, under Prof. David, has confirmed Darwin's theory of the formation of coral islands. Prof. David reports from Samoa that the expedition has been a decided success. The diamond drill went down 557 feet in the coral without reaching the bottom." October 4: "With reference to the borings on the Ellice Islands to obtain information as to the formation of coral islands, Prof. David states that the results to 487 feet were inconclusive. Beyond that they strongly favor Darwin's theory, though a final judgment depends upon microscopic examination of the drill cores. The borings are being continued." The expedition was under the auspices of the Royal Geographical Society of Australasia, and was directed by Prof. T. W. E. David, of Sydney. In view of the difficulties previously met with at Funafuti, a special boring plant was provided weighing over 25 tons, and capable of boring to a depth of 1,000 feet. It is understood, says Nature, that the core obtained will be forwarded first to the Royal Society, of London, which will return one-half to the Royal Geographical Society of Australasia.

The German expedition to the Pacific under Prof. Schauensfeld, director of the Bremen Museum of Natural Science, Ethnology, and Commerce, has produced so rich a yield that it will take a long time to prepare and arrange the material brought home, says the English Mechanic. The voyage lasted fourteen months. The professor's labors in the remote little island of Laysan, in the Pacific, were rewarded with the best results. He had splendid opportunities of observing the habits of the birds frequenting the island. Of the six species that are endemic, he collected specimens in all stages of development; he brought home several hundred birds' skins and whole nests with stuffed birds sitting in them. He obtained several turtles at Laysan, and succeeded in hatching the eggs. Sharks and thornbacks were caught. A collection was made of the flora of the island, which includes the piece of a trunk of an extinct species of palm. The fauna and flora of the sea offered a wide field of investigation, and highly interesting forms of coral are among the specimens that have been secured. Lava and various kinds of stone from the Sandwich Islands, splendid corals from Samoa, and the specimens from New Zealand and Chatham Island form an important part of the collection. The skeleton of a native belonging to a tribe that will before long become extinct is among the acquisitions. Prof. Schauensfeld regards the finding of a kind of lizard called Hatteria [Rhynchocephalus] as a special piece of good fortune. It is stated that it is impossible to give a "complete survey of the rich mass of scientific work that was carried out in the course of this voyage," but it is hinted that the professor himself will give an account, in spite of its impossibility.

The Cult of Fear.

On the subject of infantry fire, there is the danger that, in training men to seek protection, they are being trained to hide themselves, and that the military spirit of the offensive is apt to be destroyed. It is the right and duty of the officer to take account of losses, and to diminish them as much as possible, by utilizing the ground. But he must never be dominated by the fear of loss to the forgetting of the great fruits of success. Undoubtedly the training in the use of ground should be wholly eliminated from the education of the soldier, in so far as it relates to his personal security during the attack, or, as the regulations say, for the attenuation of the effect of the enemy's fire. Changes in armament have not changed human nature, and there can be little doubt but that men will be only too willing to seek protection for themselves, without being specially trained in the art of finding it. It is for the leader to decide if the conformation of the ground is favorable and admits hope of success, but, when the order to advance has been given, the man has no right to think of whether he shall go forward or not, or whether he shall find protection or not; above all things, he must go forward. We do not oppose the spirit of the German regulations, and would not habituate troops to despise the protective value of the ground they pass over; but it must be taught to them not as individuals, but as troops in the field, always under the order of their officers as to whether they shall seek its protection or not. "Let us expel from our ranks this cult of protection and fear of loss; they can only have destructive influence upon the boldness of the troops and the spirit of the offensive in them."—Militär-Wochenblatt.

A LOW PRICED GRAPHOPHONE.

The illustration represents a graphophone of very simple construction, which embodies the essential features of the high-priced machines, but which is placed on the market at a greatly reduced price, by Messrs. Hawthorne & Sheble, of 604-606 Chestnut Street, Philadelphia, Pa. It is run by a clockwork spring motor, wound by the thumb piece shown at the left in the engraving, and the same instrumental and vocal records are used on it as on the high-priced phonographs and graphophones. The reproduction of sound is, as is well understood, caused by the vibration of a diaphragm opposite the small end of the horn or trumpet, such vibration being caused by a jewel point connected with the diaphragm and which passes over the wax cylinder at the right, the surface of the cylinder having been previously indented by a like process, when a sharp cutting point has been passed over the cylinder, to indent or mark it in accordance with the sounds vibrating the diaphragm.

THE "EAGLE" GRAPHOPHONE.

Number of Naval Vessels.

Chief Constructor Hichborn, in order to settle differences of opinion that frequently occur on the subject, has issued the following official summary showing the number of vessels in the United States Navy: First-class battle-ships, 9; second-class battle-ships, 2; armored cruisers, 2; armored double-turreted monitors, 6; single-turreted monitors, 13; protected cruisers, 13; unprotected cruisers, 3; gunboats, 10; composite gunboats, 6; special class, 3; steel torpedo boats, 22; wood torpedo boat, 1; iron cruising vessels, 5; wooden cruising vessels, 11; sailing vessels, 6; tugs, 14; wooden steam vessels unfit for service, 8; wooden sailing vessels unfit for service, 6; total, 141.

A Hint to Manufacturers and Merchants.

The importance of registering trade marks at the Patent Office does not seem to be sufficiently realized by manufacturers and merchants in this country or abroad. Persons adopting a word, phrase or emblem to distinguish their specialty of manufacture, whether it be on dry goods, groceries, food products or preparations of any kind, will derive more benefit by registering them than many seem to realize. Full information as to the necessary procedure to obtain trade mark protection may be had by communicating with this office.

Recent Archæological News.

The total value of the collection left to the Institute of France by the late Duc d'Aumale is estimated by experts to be worth $3,000,000.

François Aurèle Pulsky, the archæologist, died recently at Buda-Pesth. He was the author of a work on the age of brass in Hungary.

Prof. Dr. Wilhelm Dörpfeld writes to the Times from Athens to answer the question, "Is the Parthenon doomed?" He says that the war cut off the Greek Archæological Society's large revenue from the state lottery. Repairs, therefore, have been interrupted and no one knows when they will be resumed. For the Parthenon, this is deplorable. The consequences would be most serious should an earthquake shake the mountain rock.

A preliminary report has reached London from Rome of the results of Captain Bottego's expedition in northeast Africa, says The Evening Post. They establish the identity of the Nianam River, flowing into the northern end of Lake Rudolf, with the mysterious river Omo, which so long has puzzled geographers. The river now has been renamed Omo Bottego. To the east of this river and north of the beautiful Lake Abbaye a much larger lake has been discovered, which has been named Regina Margherita.

On a stone of the temple of "Wingless Victory," on the Acropolis, at Athens, an inscription has been found stating that the monument was built by Kallicrates, who was one of the architects of the Parthenon at the beginning of Pericles' government. This fixes its date at about four hundred and fifty years before Christ. The Athens Archæological Society is about to undertake the restoration and strengthening of the Parthenon. Marble from Pentelicos will be furnished free for this by the company working the quarries.

Hollow wedge bricks were used by the Romans for constructing arches at their baths at Bath, England. According to The Engineer, the roofs of the dressing rooms were covered in some instances with flat brick arches, and, as these would have fallen in by their own weight if constructed in the ordinary manner, hollow voussoirs were moulded with a semicylindrical projection on one radial side and a semicylindrical cavity to correspond on the other. The bricks were about one foot long from intrados to extrados and ten inches wide on the back. They were finished well, and apparently of fire-burnt ordinary clay.

Signor G. B. Cavalcaselle, who, with the late Sir J. A. Crowe, wrote the well known "History of Painting in Italy" and "History of Painting in North Italy," lives of Raphael, Titian, etc., died recently at the age of seventy-nine years. He had a very romantic career, owing to his ardent liberal views, and at one time he was left for dead at Piacenza. When the French entered Rome he escaped to England by way of Paris. In London he earned a precarious living as an illustrator. He now began his lifelong collaboration with J. A. Crowe. The two writers did much to put art criticism on a sound documentary basis. Many of their appreciations were awkwardly expressed, but, for all that, their works have a very solid value to-day, and combined with the writings of Morelli, they give the student an accurate basis for determining the attributions of disputed old masters.

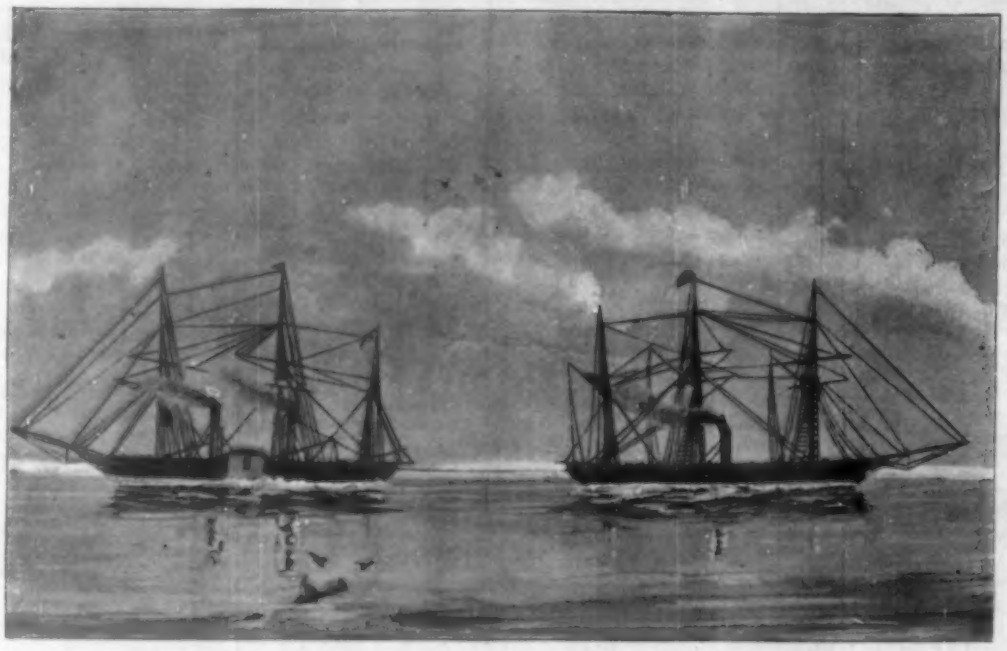
At Meron, near Angers, the remains of a Roman temple have been discovered. The French peasants are not enthusiastic archæologists, and as soon as the foundations were seen the people of the district lost no time in seeking for treasures. Some coins were discovered, and, as they were rare, the prices obtained for them increased the eagerness for further explorations. Not the least regard was given to the old masonry, from which it would have been feasible to prepare a plan of the temple. Now much will have to be derived from imagination, says the Architect. The conseil général, apprehending additional mischief, has appealed to the administration for interference. After some delay, money has been granted to the departmental commission for the purpose of insuring the safety of any masonry that has survived.

The royal British antiquarian and archæological societies have lodged a petition with Lord Salisbury protesting against the peculiar form of prison labor in Egypt since the Khedive's penitentiaries and jails have been under English management. It seems that the convicts, of whom there are twelve hundred in the Jourah prison alone, are employed in manufacturing bogus antiques, for which there is reported to be a large market, especially in America. The petitioners declare that the forgeries are so clever as to be scarcely distinguishable from the real article. As yet only antiques of relatively small dimensions have been produced, but the prison authorities express the hope of being able in course of time to turn out full-fledged mummies and sarcophagi. The scientific societies in England point out with some degree of justice that while this form of prison labor may have commercial advantages, it practically renders the British government a party to fraud.

A "TUG OF WAR" BETWEEN EARLY STEAMSHIPS.

Our English contemporary The Engineer has been publishing an interesting series of articles entitled "Shipbuilding and Marine Engineering on the Thames in the Victorian Era." We reproduce one engraving from this important series of articles. It represents the "tug of war" trial which took place on June 20, 1849, and lasted one hour, the two vessels being tied stern to stern and the engines of both set going, with the result that the screw-propelled Niger dragged the Basilisk backward against the whole force of her engines at the rate, by log, of 1·466 knots an hour. These vessels were at the same time tried at different depths of immersion, and the conclusions arrived at from the results obtained were that, in similar vessels exerting the same amount of engine power and impelled by steam alone at their highest obtainable speed, the screw is the most advantageous propeller at deep immersions and the paddle wheel the best in the case of light and medium immersions.

Both the vessels were fitted with four hundred nominal horse power engines. The propelling engines of the Basilisk were of the ordinary oscillating type and those of the Niger were a special kind of direct acting horizontal engine, having two pairs of cylinders; one pair being placed on each side of the main crank shaft, with an air pump between. Each piston had two piston rods working in different planes, one being above and one below the crank shaft, the rods of each pair of cylinders being connected to one crosshead, from which a connecting rod passed to the crank and put its shaft in motion. The air pumps were worked by a similar arrangement to that by which the motion of the pistons was communicated to the cranks, the whole forming one of the best examples of direct-action engines that had at their time been produced.



"TUG OF WAR" BETWEEN BASILISK AND NIGER, 1849.

TRIAL TRIP OF A BRITISH BUILT TORPEDO BOAT DESTROYER FOR THE SPANISH GOVERNMENT.

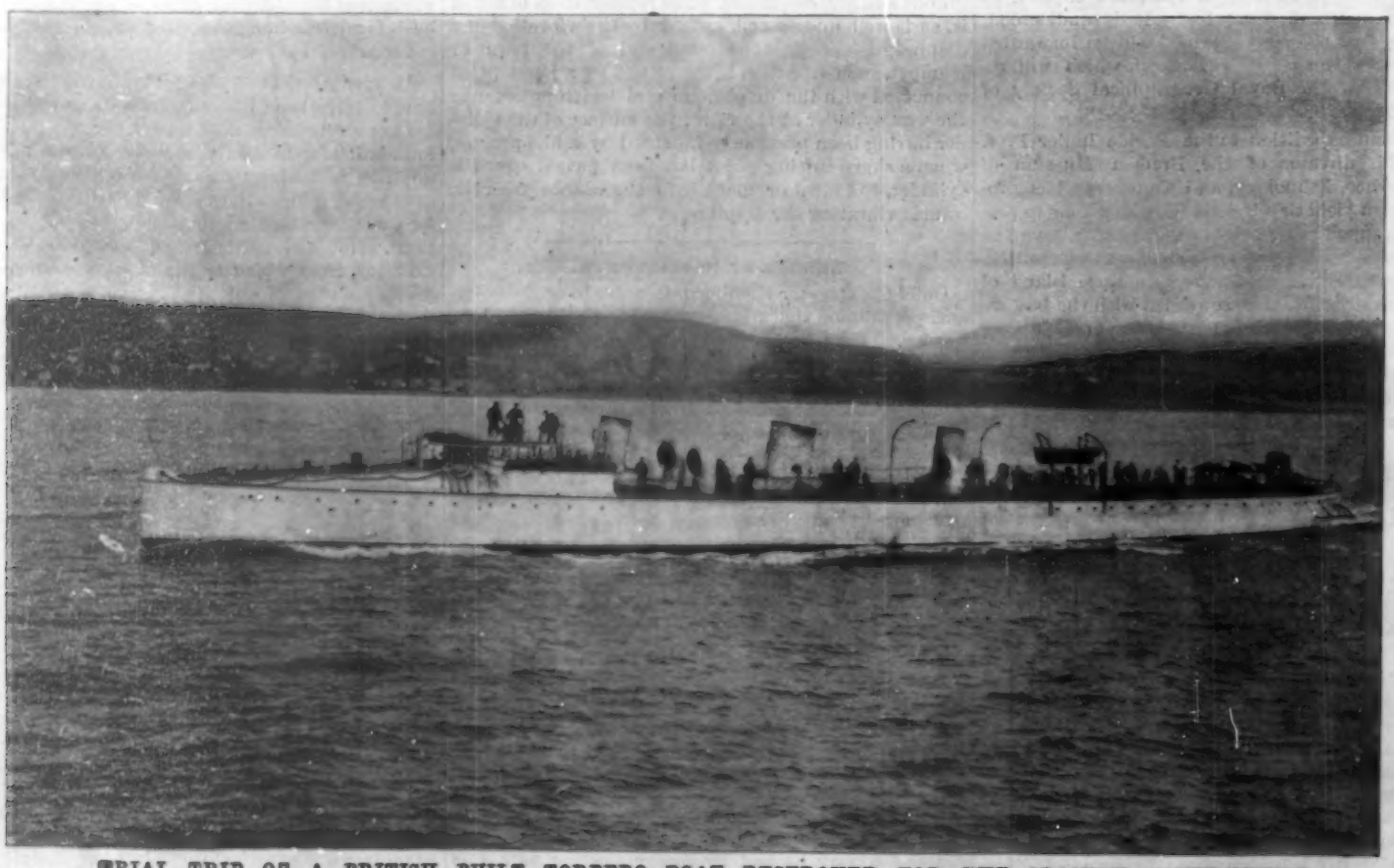
BY OUR ENGLISH CORRESPONDENT.

The official speed trials of the torpedo boat destroyer Pluton, of 400 tons and with engines of 7,500 indicated horse power, which was constructed by the Clydebank Engineering and Shipbuilding Company (Limited), near Glasgow, to the order of the Spanish government, were successfully carried out on the Clyde on Thursday, November 4. On behalf of the Spanish government the tests were watched by a government commission under the presidency of Commodore Triguiro, with whom were Lieutenants Ariba, Guimira, Vazguay, Naval Architect Taliso, Messrs. Thomson, Gordon and Haynes. The Pluton, which is one of a number of destroyers building at Clydebank for the Spanish government, is 225 feet long, and is thus somewhat larger than the latest class of British torpedo boat destroyers. She is therefore enabled to carry a considerably greater dead weight, the actual load on board during the trials being 73 tons. The results of the trial gave a mean speed of 30·12 knots on the measured mile, and during a continuous run of one and a half hours a speed of 30·02 knots was maintained. At the conclusion of the forced draught trial, the vessel was, according to contract, run for a further period of two hours under natural draught, the speed attained being 22·7 knots, or $\frac{7}{10}$ of a knot over the contract. During the tests there was a noticeable absence of vibration and the engines worked to the entire satisfaction of the Spanish commission.

The Measurement of Memory.

Prof. Alfred Binet, the celebrated French psychologist, in a paper in the Année Biologique on "The Experimental Study of Memory," treats of this among other related subjects. We quote the following from an abridgment printed in the American Naturalist:

"Although the methods used for measuring the memory may have been crude, as they still are, it is nevertheless a great advance to be able to introduce the concept of measurement into this problem at all. So far attempts have been made to measure but one kind of memory—the direct faculty of acquisition. The experiments deal with the number of memory images that can be stored up at a single trial, without allowing the subject time to rest. This is called in English the 'mental span' of the memory. I have proposed for it the term '*faculté de prehension*' Several successive investigations have already been made on the measurement of the memory for figures and syllables. These are localized memories, the development of which cannot be considered as a sign of the development of the other memories. We must, therefore, make many reservations in interpreting the conclusions to be drawn from these experiments. The experiment may be made as follows: A series of figures is read to the subject at a regular speed (the speed used is in general two figures per second) and without any special accentuation. As soon as he has heard the series, the subject, having been told beforehand of the requirement, endeavors to repeat the figures without error and in the order in which he heard them. The experiment is repeated several times, beginning with a small number of figures, e. g., four which any adult can give correctly: it is then increased to five figures, then to six, and so on, until a number is reached which the subject can no longer repeat correctly. Care is taken to repeat each trial, and to allow sufficient intervals of rest to avoid fatigue and the confusion of figures in the memory. This procedure, adopted by Jacobs, Galton, and many others, has already borne fruit. It is not, properly speaking, a test of the memory alone; it is extremely difficult, be it said in passing, to experiment on any isolated psychological phenomenon. The experiments taken together show, on the contrary, that the subject employs not only his memory, but also his powers of voluntary attention. This explains why children retain fewer figures by this method than adults. Their inferiority is certainly due to the fact that they have less control over their attention. The average educated adult retains seven figures; a child from six to eight retains five; a child of ten retains six. A difference of one single figure is of considerable importance in the results, and it is one of the drawbacks of this method that we cannot operate with fractions of figures. I have had occasion to measure the retentive memory of Jacques Inaudi, the celebrated lightning calculator. He is able to commit more than forty figures at one trial. It will be seen from this how far his memory is above the average."



TRIAL TRIP OF A BRITISH BUILT TORPEDO BOAT DESTROYER FOR THE SPANISH GOVERNMENT.

LIBRARY

THE BUCHANAN-GORDON DIVING DRESS.

BY OUR ENGLISH CORRESPONDENT.

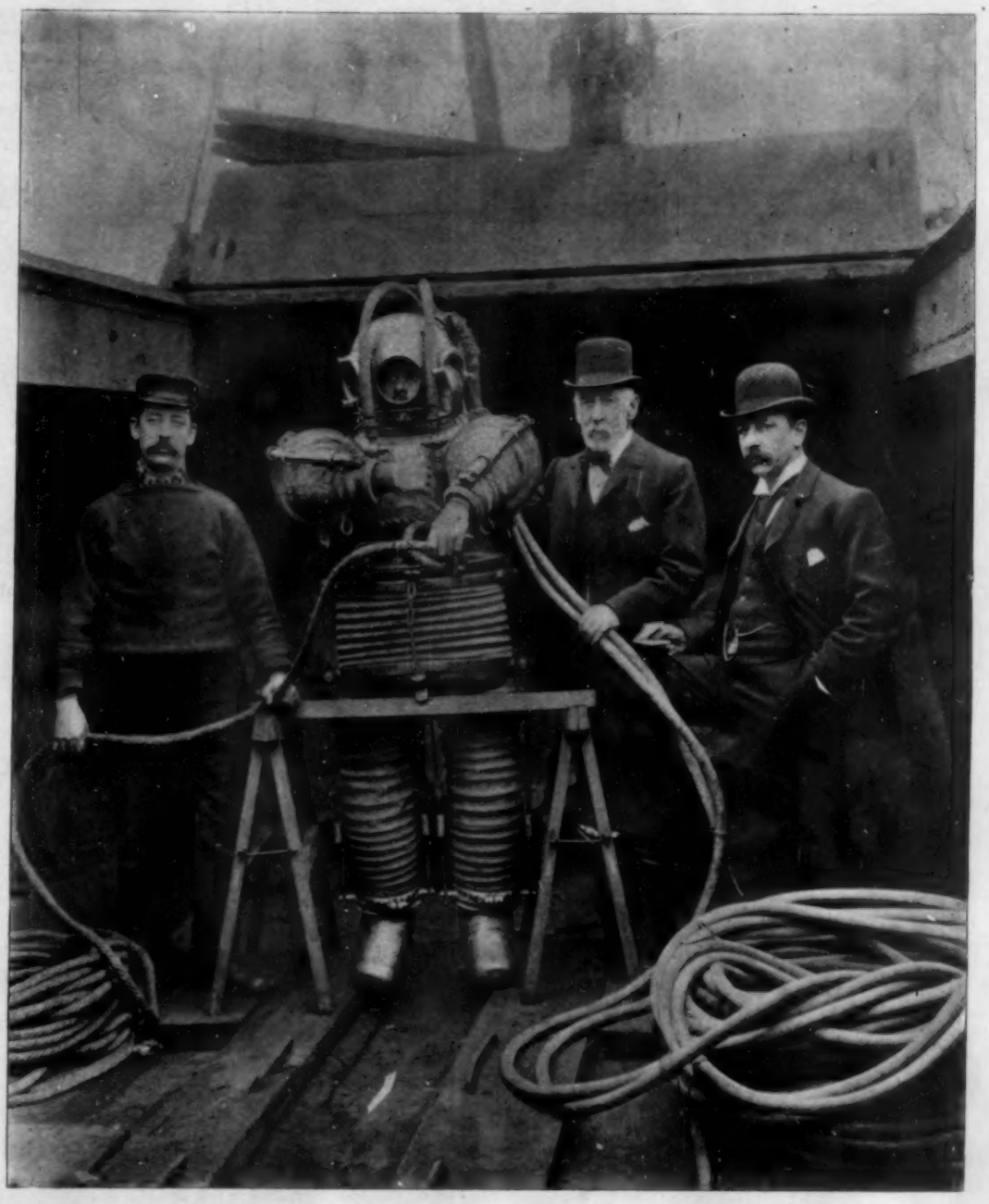
We herewith present a photograph of a diver clad in a new diving dress known as the Buchanan-Gordon diving dress, and the two gentlemen standing to the right of him in the picture are Messrs. W. W. Gordon and A. Gordon respectively. The gentlemen mentioned arrived in Great Britain recently from Melbourne, Australia, for the purpose of showing Britishers their improved deep sea diving apparatus, which has been generally adopted in connection with pearl fisheries in the colonies. With a view to clearly demonstrating its advantages, the patentees, after a number of successful experiments in Australia, brought a couple of dresses to London. They received every assistance from that famous firm of submarine engineers Messrs. Siebe, Gorman & Company, London, the principal partner of which had the honor of designing the present day dress.

The chief diver of the firm, the famous W. R. Walker (who is represented in the photograph wearing the dress), was granted liberty to assist in the experiments, which took place on the Clyde during last month from Messrs. Ross & Marshall's steam yacht Aerolite, which was chartered for the work. After accustoming himself to the new dress and familiarizing himself with the currents, etc., Walker bottomed 31 fathoms, or 189 feet. He was under the water for fifty minutes, during which he was subjected to a pressure of over 80 pounds to the square inch, but on coming up he was quite fresh. The next time Walker went down on the Clyde there was present a large gathering of well known experts. Some trouble was experienced in fathoming a sufficient depth, but after a time a lovely spot was found at the mouth of Lochgoil. The line showed a depth of 33 fathoms, but the yacht swung round a little, and when Diver Walker reached the ground the indicator pointed to 31 fathoms, or roughly speaking, about 186 feet. Walker was under the water forty minutes, and while on the ground he unhooked a block which was fastened to the bottom of a separate line, and brought it to the surface. On regaining the boat and divesting himself of the dress he showed not the slightest signs of exhaustion, and on all hands the experiment was voted a great success. This depth has never before been attained in Great Britain. Walker spoke highly of the dress, which he describes as an admirable one for its purpose—deep sea diving.

In the present day he has never been deeper down than 133 feet or 22 fathoms. While on the ground he said he moved about with as much ease and comfort as he had done at a depth of 15 fathoms in the old dress. During the experiments the pumps, air hose, and lately designed telephone (never before used at such a depth) of Messrs. Siebe, Gorman & Company were used. The diver was delighted with the telephone, through which while he was below he spoke to his attendant on the deck of the vessel.

To prove the efficiency of the Buchanan-Gordon dress, a novice tried it, and in his first attempt he bottomed 10 fathoms, the next day he managed 15 fathoms and his next trial he fathomed 19½ fathoms. The dress has been designed to meet the requirements of all descriptions of deep sea diving up to 30 fathoms, or at even greater depths. The invention is a dress which in itself withstands the tremendous pressure of great depths, enabling the diver to breathe a normal air pressure. It is in effect a suit of armor which defies all assaults, yet enables the wearer to move about with the utmost ease. The most important part is the helmet, which descends to the waist in one piece of solid copper, and weighs no less than 2½ cwt., while the dress weighs 5 cwt. The arms and the lower half of the dress consist of a series of spiral springs covered with waterproof material, which at the same time gives strength and mobility. These springs are made of Delta metal—a phosphor bronze of immense strength. By a series of ingenious arrangements the suit can be adjusted to the height of the diver, and there is a jointed brass support running along the outside of the legs, which is intended to prevent the horrible accidents which might be caused by the upward pressure of the water. But perhaps the most interesting portion of the Gordon dress is the escape valve. Presuming a diver to be at a depth of 26 fathoms, he would have to stand a pressure of 69 pounds to the square inch; and, therefore, an air pressure of more than this amount would have to be pumped into the diver's dress in order that the escaping air might overcome the external resistance. But in the Gordon process this difficulty is overcome in a very simple manner. The escape valve, which is perfectly under the diver's control, is attached to a floating hose, the upper end of which can be submerged at any required depth below the surface. This reduces the head against which the air escapes and thereby permits the pressure of air supplied to the diver to be proportionately diminished.

But perhaps the most valuable feature of the invention is the capacity of the dress for retaining air.



EXPERIMENTS WITH A NOVEL DIVING SUIT IN ENGLAND.

A Greek City Unearthed.

Private letters just received in this country by a correspondent of the New York Tribune bring news of most important discoveries made by the German archæologists excavating on the site of the ancient Priene, in Asia Minor, opposite the island of Samos. Years ago an English expedition excavated and studied the Temple of Athena, the chief sanctuary of the city, built at the order of Alexander the Great. The work was then abandoned, and meanwhile the ruins have been so thoroughly exploited and wasted by the neighboring population that nothing is left but a confused heap of stones. In 1895 the work of exploring the ruins of the city was resumed, this time by Germans under the direction of the Berlin Museum and at the expense of the Prussian government. The architectural work has been placed in the hands of the young architect Wilhelm Wilberg, a former student and assistant of Dr. Dörfeld.

The work has now proceeded far enough to determine its extraordinary importance. A buried city preserved almost in the completeness of Pompeii is coming to light. Up to this time no Greek city has been excavated that gives any clew to the arrangement of streets, public squares, monuments and public buildings, or to the architecture of any considerable number of private houses. Here we find a city, to be sure, of the Hellenistic period, laid out with great regularity, with streets crossing at right angles, with shops, colonnades, market places, theaters, a council house, and a great number of private houses preserved in such completeness as to display their general architecture, distribution of space, use, decoration and equipment.

South of the great square of the temple alluded to above, and closely adjoining it, has been found the great market place or agora of the city, which was surrounded on all four sides by broad colonnades, of which that on the north side was peculiarly noble and stately. Adjoining this at one end, and opening upon one corner of the agora, was found a small square building constructed somewhat like a theater, which was evidently the council house of the city. It is marvelously well preserved. Sixteen rows of seats are still in place. The walls, doors, windows, platforms, etc., are all preserved. One of the side walls ends in a massive arch, which, as being demonstrably a wor of the fourth century B. C., must rank as the earliest, or at least one of the few earliest, specimens of the arch in Greek construction. The whole building represents something entirely unique in the relics of Greek architecture.

There has also been found a small theater in which the stage structure, the skené, is still standing entire. Three doors open from it upon the orchestra, and the proscenium, with its rows of columns and the architrave above them, remains intact. No Greek theater as yet discovered is so perfectly preserved as this, and in the future discussions of the "stage question" this structure is likely to assume a leading place.

The Present Price of Aluminum.

The Aluminum World contains each month the latest price list for aluminum in all forms. Our readers will doubtless be interested in knowing the present quotations.

Aluminum ingots, guaranteed to be over 99 per cent pure, cost 40 cents a pound in small lots and 34 cents in ton lots. Aluminum guaranteed to be over 90 per cent pure for alloying with iron and steel costs only 31 cents in ton lots. Special casting alloy containing over 80 per cent pure aluminum for use in place of brass costs 27 cents a pound. Aluminum castings cost 45 cents and upward a pound. Aluminum bronze ingots containing 2½ per cent of aluminum cost 13 cents a pound, while those containing 10 per cent cost 16 cents.

Aluminum rods cost 53 to 55 cents a pound, and rolled squares and other sections, in orders of not less than 1,000 pounds at a time, $1 a pound. Plate and sheet aluminum costs from 40 cents to $2.90 per pound, while wire costs from 55 cents to $4.80 per pound. Finely powdered aluminum for paint, printing and other purposes costs $1.75 a pound.

Aluminum is now so cheap that it is used in many cases as a substitute for brass.

PERHAPS the largest house in the world is in Wieden, a suburb of Vienna. In this domicile there are 1,400 rooms, divided into 400 suites of from three to six rooms each, and they at present shelter 2,112 persons, who pay an annual rental of over 100,000 florins.

AN IMPROVED BICYCLE BRAKE.

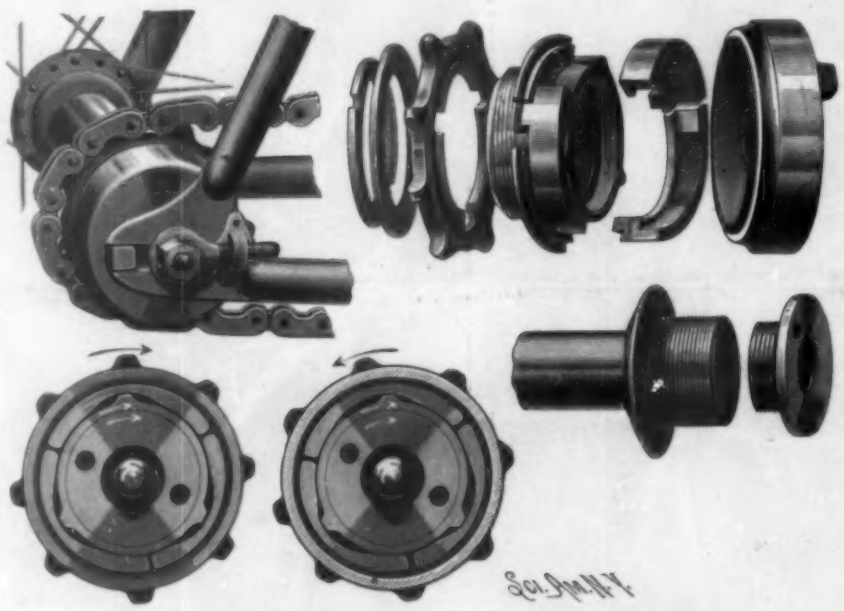
The brake shown in the illustration is the invention of James H. Bullard, of Springfield, Massachusetts, and has been patented in the United States and ten or twelve foreign countries. The brake will be manufactured by the Spaulding Machine Screw Company, of Buffalo, N. Y., and we are informed that it will be found on some of the leading wheels of 1898.

Like all rear hub brakes, it is actuated by back pedaling, and its construction is so clearly shown in the illustrations that an extended description thereof is not called for. Suffice it to say that a sleeve screws onto the hub and is locked thereon by a check nut which may be screwed either into the end of the hub, as shown, or onto the outside thereof. The sprocket rotates on the sleeve within the limits of the slots in the flange on the sleeve through which the studs on the brake shoes pass to engage in slots in the web of the sprocket. In one of the figures one brake shoe is shown on the flange and the other two removed therefrom. When pedaling forward, the said studs abut against the forward ends of said slots in the flange to drive the machine. When back pedaling is applied, the sprocket moves the brake shoes backward circumferentially on the sleeve, and the inclines on the underside of the brake shoes ride up on the projections on the sleeve, lying under the center of the brake shoes, and the latter are moved outwardly into engagement with the case, which is stationary and concentric with the hub. The slots in the web of the sprocket are inclined relative to the center of the hub, to the end that in pedaling forward the brake shoes may be forcibly held against the sleeve and out of contact with the case. The circular nut and its checknut on the rear end of the sleeve serve to clamp the web of the sprocket between it and the flange on the sleeve, whereby the sprocket is made to rotate on its hub under more or less resistance. This adjustment can easily be made in a few moments from the rear of the machine and is a very important feature, for it enables the brake to be adjusted to suit the strength of any rider—man or child. It is obvious that a back-pedaling brake which could be operated by a child would be unfit for use by a heavy rider, as the latter would unconsciously apply the brake by very light back-pedaling pressure put upon the cranks. Furthermore, this sprocket resistance aids in holding the brake set when once it has been applied.

Another important feature of the brake is that its construction insures the rider against loss of control of the machine, however inexperienced he may be; for, as the brake shoes are moved to the rear to apply the brake, as soon as they come into contact with the case the friction between the latter and the shoes tends to cause a still closer contact between them as the speed accelerates, for this friction tends to cause the brake shoes to move still further in the direction given to them in the first instance by the sprocket wheel, thus setting the brake harder.

Notwithstanding the fact that the brake is, in a manner, self-setting, as above described, the self-setting movement is always a gradual one, for even if the brake is but lightly set the shoes are more or less wedged between the case and the projections on the sleeve, and hence quite a little power must accumulate before they will move, and the farther to the rear they move the harder they move, for they are constantly being wedged harder against the inside of the case, and besides this there is the sprocket resistance to overcome, so it is at once apparent that the brake cannot be set too suddenly by reason of its being partly self-acting.

It is obvious, therefore, that, should a rider start coasting down a hill with the brake too lightly set and the feet off the pedals, any increase in the speed of the machine would set the brake harder, and finally bring it to a stop. If a rider should lose the pedals with the brake not set, it is only necessary to hold the toe of the foot so that the flying pedal can strike it, and the brake is immediately brought into action and brings the machine under control within a few revolutions. It is a safe coasting brake, a brake that can be suited to all classes of riders—a strong brake, acting with a minimum of backward movement (about one-eighth inch on rear sprocket), and as light as it can safely be made (weight seven ounces), and it is mechanically perfect.



THE BULLARD AUTOMATIC REAR HUB BRAKE.

A STATUE of Balboa, the discoverer of the Pacific Ocean, will be erected in Golden Gate Park, San Francisco. It will be executed by Mr. Douglas Tilden, and is the gift of Mayor Phelan.

The Artificial Coloration of Flowers.

BY WILLIAM BROCKBANK.

The excitement about blue carnations led my neighbor, Mr. W. Dorrington, and myself to endeavor to solve the mystery by imitating it, and we soon discovered that, although flowers could not be tinted by immersing them in dye solutions, they could readily be colored by placing their stalks in aniline solutions.

Aniline scarlet dissolved in water to about the transparency of claret has a very rapid action on flowers, coloring them pink and scarlet. Indigo carmine produces beautiful blue tints. The two combined dye various shades of purple, with curious mottled effects, some parts of the flowers becoming pink and other parts blue and purple. Greens are produced by using the blue dye with yellow. We also tried indigo and cochineal, with partial success. Lily of the valley flowers became beautifully tinged with pink or blue in six hours; narcissi are changed from pure white to deep scarlet in twelve hours, and delicate shades of pink are imparted to them in a very short time. Yellow daffodils are beautifully striped with dark scarlet in twelve hours; the edges of the corona also become deeply tinged, and the veining of the perianth becomes very strongly marked. Coelogyne cristata, Lapageria alba, Calla æthiopica, cyclamens, snowdrops, leucojums, hyacinths, Christmas roses, Solomon's seal, tulips, and many leaves were found to become colored very quickly by the process.

The more interesting question of how this rapid change is brought about soon attracted my attention, and proved extremely interesting. The coloration is mainly confined to the vessels. There is a system of veins in plants, the vein tubes being clearly seen under the microscope, passing through the leaves, petals and other parts of the flowers. In these tubes the motion of the colored water can be seen, and it became evident that it was by these that the color is conveyed and left in every portion of the plants. In the case of cut flowers the action is very rapid, the water tubes beginning at once to absorb the fluid, which was passed along by either capillary attraction, contraction or possibly by some more active life force acting within the veins. My experiments in proof of this were made at first entirely with cut flowers. I afterward tried the experiment by taking a Roman hyacinth very carefully out of the soil and placing the roots in aniline water. In twelve hours the petals began to color, and the flowers gradually became pink tinted throughout. This experiment was repeated on many narcissi and other bulbs. It cannot, however, be said that the root fibers were unbroken. Probably they were so, as I have failed to color any flower by merely watering the soil with colored water. The filtering appendages to the roots evidently prevent the absorption of much of the color, as the petals of the flowers do not become either so quickly or so deeply tinged when the plant has its root as with cut flowers. It was, however, clearly seen that the vein tubes proceeded from the root, thus completing the water system of tubes from root to flower.

The veins when colored are beautifully seen under the microscope as clear tubes running in parallel lines, the interspaces filled by cellular matter. The tubes gradually branch out as they proceed, and as they approach the margins they are finely branched. When the colored water reaches the margins of the petals they thus become deeply tinctured, especially in the narcissi, illustrating the cause whereby the daffodil so frequently obtains the deeper color at the edge of the corona. It is the same with the leucojum and the snowdrop.

Very singular results were obtained in the variegated leaves of the aucuba and ivy plants, which, at the winter season, one would suppose had the leaves quite dormant. Single leaves with their stalks placed in aniline dye water began to color in about three hours. They were thus shown to have the absorptive power quite apart from the stem.

Another remarkable instance was seen in Lapageria alba, which has a very thin, wiry stalk and a large, waxy flower. With the stalk placed in dye water, the whole flower became beautifully veined with pink in three or four hours—a singular fact when one considers the minuteness of the tubes through which the liquid has to be drawn. It is difficult to believe that this can be accomplished by capillary attraction only. In Eucharis amazonica, which has thick stalks, the flower does not become tinted at all, but the style is dyed a deep red. The pistils of flowers always become deeply colored, which is an important fact, showing that the solid matter of the coloring solution is thus secreted (deposited) by the fruiting vessel of the flower. White tulips furnish excellent illustrations of artificial coloring, as they can be readily tinted either pink, blue, green or purple in a few hours. The vein tubes which are thus displayed in the petals agree with the strongly marked features, known as the "flamed" or "feathered" varieties, of the florist. It is generally known that all tulips raised from seed are self-colored when they first bloom. They are then called "breeder tulips," and the enthusiastic amateur florist grows on his "breeders" for six or seven years, until they "break," when they become either "flamed" or "feathered" varieties. Now a florist may ascertain in six hours whether his breeder tulip will become a feathered or a flamed sort, and whether it will be worth growing on for the breaking time, because the veining of the petal is shown by the color, and it is that which makes the feature when the tulip is fully matured. Blue tulips have always been desired, and they can thus be artificially produced for florist purposes.

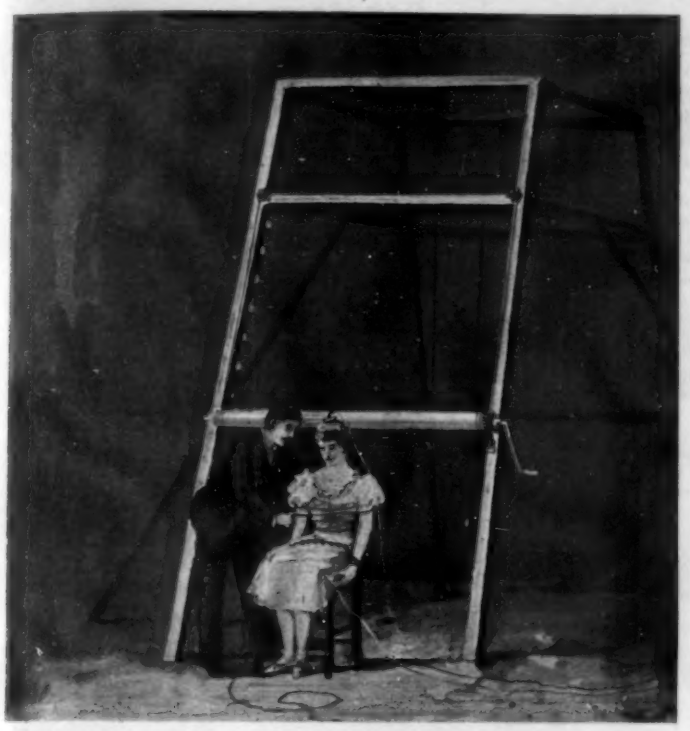
Daffodil and narcissi generally can be greatly varied in color, and especially by showing their exquisite veining when thus treated. The tube and the corona take a darker and richer tone of color than the perianth, thus agreeing with the fact that all daffodils are more or less dicolor. The Christmas rose is also an interesting flower when artificially colored. Straight tubes cross the petals from base to point, with numerous cross tubes, and the main ones branch out angularly, thus dividing the snow-white petals in a network of red lines. The interspaces are filled with oval cellules, and as the tubes are permeable, the cellular spaces become suffused with a delicate shade of pink. Snowdrops and leucojums are also very interesting when thus treated. Their petals are veined with about eight tubes at the base, which pass across the petal to its point in nearly parallel lines, strongly and clearly marked. These are branched near the tip of the petal in fanlike form, producing rich pink margins to the flower. The double white camellia is another very pretty illustration, as it easily assumes a pink shade throughout. It is difficult to imagine how this is done, as the camellia has a small woody stalk, and in the case of a double flower, with forty or fifty petals, the attachment of each of them to the tube in the stalk must be very slight, and yet every petal becomes tinted in a few hours.

White lilacs take the color perfectly, becoming either pink or blue at pleasure. The abutilon has the calyx colored, but not the petals. These are already strongly vein-marked, and they seem to refuse the new comer. Primulas take the color readily, but the common wild primrose will not be changed. Forced leaves of the Swede turnip, grown in the dark for culinary purposes, are extremely susceptible to coloration. They begin to color in about three hours, and in twelve hours are beautifully fringed with red, and suffused with rich orange. Thus tinted, they are beautiful objects for table decoration.—Gardeners' Chronicle.

A SANITARIAN who visits the palace of Versailles should never inquire about the arrangements in which he has interest. In its palmy days it possessed only a single bathroom, which was never used. A colossal "vasque" of marble was placed in one of the corners of the building, but neither the Grand Roi nor one of his marshals could attain the courageous mood that was necessary in order to bathe in so much water. As the marble bath was useless, Madame De Montespan asked for it, and Louis XIV was glad to be rid of so unnecessary a superfluity. It was placed as an ornament on the lawn of her property, the "Ermitage," and there it remains.

"GONE."*

This clever illusion was designed by Mr. W. E. Robinson, the assistant of the late Herrmann the Great. It has been exhibited in several of the large cities, and is always a great success. When the curtain is raised, the square frame is seen; this frame is braced laterally by side pieces. At the lower part of the frame, within easy reach of the prestidigitateur, is a windlass. Ropes pass from this windlass, over pulleys, to a crossbar in the upper part of the frame. A lady is now brought upon the stage and for some terrible crime is sentenced to be electrocuted. She is seated in a chair, which she grasps tightly. She is then tied tightly to the chair with ropes, and her hands are chained together. The prestidigitateur now secures the chair, with its fair occupant, to the ropes which are connected with the windlass, by means of hooks which fasten to the top frame of the chair. Wires are now secured to the unfortunate lady, so that it really seems as though she was to receive the death-dealing current. The professor of magic now winds away at the windlass and raises the chair until the head of the victim is on a level with the crossbar. He then discharges a pistol, and at the same instant the lady disappears and the chair drops to the floor. Such is, in brief, the mode of operation of the trick called "Gone."



THE LADY READY FOR ELECTROCUTION.

In reality the illusion is a clever adaptation of the "Pepper Ghost," of which we have already described several variations. A reference to our first engraving will show at the sides of the frame a row of incandescent lights. While the lady is being secured to the chair, and while she is being hoisted up to the crossbar, these lamps are kept lighted; but the instant the pistol is fired, these lights are extinguished by a stage hand in the side scene. Up over the proscenium arch is arranged a background which corresponds to the background of the stage. Two wooden bars cross it. Directly below this screen, and carefully shielded from the observation of the spectators, is a row of incandescent lights. As the pistol is fired these lights are turned on, while those in the frame are extinguished. Now, according to the principles of the "Pepper Ghost," which we have already described, the person or thing which is brilliantly lighted has its image projected on a sheet of glass and appears to be real. The front of the frame, from the windlass to the horizontal cross piece, is covered with a sheet of glass which is not apparent to the audience.

The image of the background is projected upon this glass, which hides the lady from view, although she is immediately behind it, and the pieces of wood and this artificial background take the place of the back posts of the frame, thus deceiving the audience. The chair is made in two sections, the lady being tied to the upper or skeleton chair. She holds a heavy chair with her hand tightly, and at the instant when the pistol is fired she releases the chair, which falls to the floor with a loud noise.

There is another illusion, called "Out of Sight," invented also by Mr. W. E. Robinson, which is somewhat similar, but is not as interesting from a scientific point of view. It is, however, better adapted for a traveling company, as there is no glass to break, the large sheet of plate glass in the front of the frame being entirely dispensed with. When the pistol is fired, a curtain of the same color as the background is released by the prestidigitateur, and it is drawn down quickly by means of rubber bands. It takes only an instant for the curtain to descend, its lower edge being hidden from view by the windlass. The audience is usually deceived as easily by this illusion as by the more complicated one.

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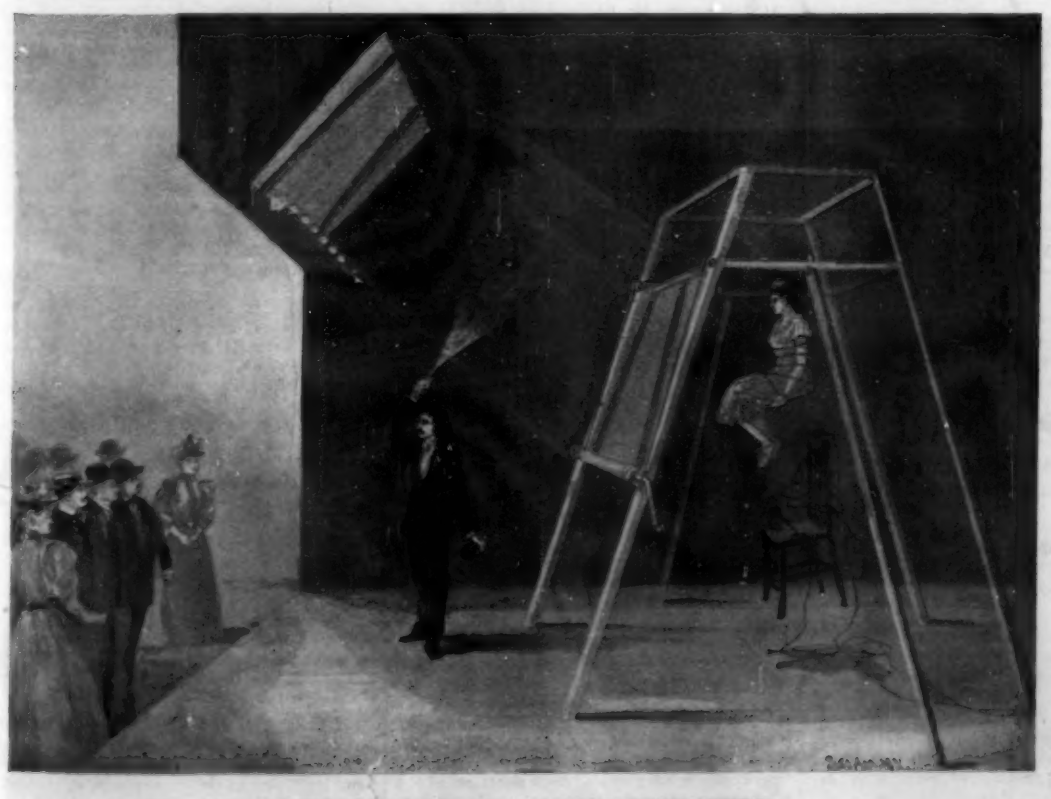

THE ILLUSION OF 'GONE" EXPLAINED.

Sectionalized Machinery.

In the light of modern engineering achievements it is safe to say that there is no mine situated in so inaccessible a place that it cannot be worked if it is rich enough, says The Engineering and Mining Journal. It is a greater evidence of our engineering skill, however, that many mines which are not especially rich can be operated profitably in remote places whither a wagon cannot be driven. We have perhaps the most remarkable instances of this kind in Mexico, where the cordillera has a precipitousness that is nowhere approached in the United States, where there are few railways besides the main north and south lines, and wagon roads are scarce. When, therefore, one comes across a stamp mill loudly pounding away at the bottom of a barranca in the heart of the Sierra Madre, or a smelting furnace belching its black smoke, one may well be lost in astonishment at their being there at all. That they are there is due chiefly to the ingenuity of mining machinery makers in dividing their apparatus in such a way that no part of it will weigh more than a mule can carry. This is a branch of work in which American machine works have excelled, and their experience in it is now so complete that the engineer can safely intrust to them his orders for almost any kind of apparatus.

The maximum load that the Mexican mule can carry in the Sierra Madre is 350 pounds, and this requires a specially picked mule. The ordinary mule load is only 300 pounds. It is necessary, therefore, that there shall be no piece of machinery weighing more than 350 pounds, and those of that weight should be few in number. The most experienced machinery makers are generally able to keep within these limits. Such apparatus as boilers and water jacket furnaces are shipped, of course, in nested plates, which have to be set up and riveted on the ground.

A no less important requirement than the weight of a piece is its length, since a mule cannot safely make the sharp turns of a narrow mountain trail with anything longer than nine feet on its back. This restriction, which obviously applies to lumber as well, often increases very much the difficulty of mill construction, since there are numerous mining camps in Mexico where every stick of timber that is used must be brough in by muleback or on the shoulders of men.

RAISING THE LADY BY MEANS OF THE WINDLASS.

The Naphtha Industry in Baku.

The Kolonialwaaren Zeitung says: Since the discovery, not so very long ago, of the great naphtha riches of the environs of Baku, Russia, that city has developed into an important industrial and commercial center. It is true the oil springs of the Apscheron Peninsula have, since the time when the first drills were made, decreased considerably in productiveness, and the spontaneous effusions are no longer as frequent as in the beginning. Nevertheless, enormous quantities are still produced, and an exhaustion of the subterranean naphtha reservoirs need not be apprehended for the time being. Single wells yield, during short periods, 3,000 to 5,000 barrels per day. The British consul at Baku ascertained that a single well produced no less than 10,000 barrels per day, which meant a daily income of $25,000 to the owner. The productiveness of the well did not remain so great for a long time, but in the course of two months it yielded in the aggregate 300,000 barrels, valued at $750,000. The product of all the springs together, no matter how enormous the quantities, always finds ready buyers at current market prices, which are but little influenced by the size of the offerings. The mineral oil is always carried away as soon as possible, to be either shipped in a crude state or else to be worked up in Baku. There is a large number of refineries in Baku, where naphtha is turned into numerous varieties of oil and kerosene products. Large quantities of refined petroleum are shipped from Baku to many more important places up the river Volga, as well as to other Russian and Persian ports of the Caspian Sea. A considerable portion of the products is sent by rail to Batoum, from which port it is shipped to all parts of the Black Sea.

A DISCOVERY has just been made in the archives of the Vatican. It is a collection of medical prescriptions for diseases of the eye, in the handwriting of Michelangelo. He was much troubled with his eyes in old age, and he seems to have made a record of all the remedies which were prescribed for him.

RECENTLY PATENTED INVENTIONS.

Engineering.

GAS ENGINE VALVE GEAR.—Frank S. Mead, Montreal, Canada. For four-period gas and oil engines this invention provides an improved valve gear arranged to positively and directly operate the valve from the engine shaft, dispensing with the usual side shaft, gears, cams, etc. The invention consists principally of a wheel for controlling the movement of the valve, the wheel having an intermittent rotary movement and a reciprocating travel in the direction of the valve stem. The device also forms a mechanical movement which may be used for various other purposes besides a valve gear.

SMOKE AND GAS CONSUMER.—Arthur B. Moore, East Las Vegas, New Mexico. This invention is for a furnace more especially designed for use in locomotives and marine and stationary engines, to insure the complete combustion of the burning fuel. An open pipe frame is arranged in the top of the fire box and along its sides and ends, directly below the crown sheet, the frame being connected with an air supply and each pipe having an inwardly opening longitudinal slit to discharge air upon the burning fuel. The pipes are protected by water jackets in which a free circulation of water is arranged for.

WATER ACCUMULATOR.—Carlo Coda, Civita Vecchia, Italy. To facilitate supplying railway locomotives with water in less time than has heretofore been practicable, this invention provides an apparatus comprising a main reservoir connected with an auxiliary reservoir or water tower which has an airtight cover continued upwardly beyond the level of the main reservoir, a discharge nozzle being connected to the reservoirs The construction obviates danger from freezing, as the water is almost continuously in motion, and the dimensions of the several parts are such that the auxiliary reservoirs are filled in about the time equal to the smallest interval between trains.

MEANS FOR CONVERTING MOTION.—Aaron B. Perine, Topeka, Kansas. This invention is in the nature of an improved engine for transmitting power efficiently and with but little friction. It comprises a circular track on which travel with a gyratory motion one or more upright wheels, each having teeth on its periphery, a driving gear wheel meshing with the teeth of the gyratory wheel, there being means for rotating the gear wheel, and a circular series of ball bearings to resist the outward trend of the gyratory wheel at the upper and lower points of contact.

Railway Appliances.

CAR COUPLING.—James S. Bartley, Whitesville, Ga. In couplings of the gravity pin-and-link type, this invention provides an improved coupling adapted for automatic coupling, and which may also be uncoupled from either the top or side of the car. A spring-cushioned coupling box at the front end of the drawhead is divided into a number of link-receiving compartments through which passes a vertically adjustable coupling pin adapted to hold the link at different heights and angular adjustment for engagement with another coupling on a car that may be higher or lower.

Miscellaneous.

STOOL ADJUSTING DEVICE.—Thomas W. Gilbert, Boston, Mass. To facilitate the adjustment upward or downward of the seat of a stool, and permit the seat to be revolved without raising or lowering it, is the object of this invention, which affords an adjusting mechanism actuated mainly by the foot, but with which the seat may not be raised or lowered while occupied. Combined with the frame is a toothed rod meshing with a gear wheel, toward and from which is movable a locking device.

STORE SERVICE APPARATUS.—William H. Brundage, Hudson, N. Y. To facilitate sending and returning money or change box carriages over wireways in stores, this invention provides improvements whereby the carriage is propelled without the use of previously stored-up power, and is received and held at the receiving end without undue jar to the apparatus. The invention consists principally of a spring-pressed picker stick adapted to engage and move the carriage backward into propelling position, the stick being then suddenly released to send the carriage over the line, the carriage being received by ball-pointed, curved gripping arms to break the force of its movement and securely hold it.

INCANDESCENT BURNER FOR LANTERNS.—James W. Dearing, Brooklyn, N. Y. In this burner threads or filaments of asbestos or similar material, or platinum wire, are supported over a flame, preferably a spirit flame, the filaments being adjustable in a manner to center them upon the lens of a lantern. The filaments are so supported that they will become incandescent from end to end, and means are provided for attaching a fuel reservoir containing oil or spirits to the body of the lantern in such manner that the two parts will be held firmly together, while the parts may be quickly removed or connected, and a perfect draught may be obtained.

WINDOW SASH.—Alfred F. Smith, Las Vegas, N. M. According to this improvement, the window frame has vertical beads forming two vertical slideways, and in each guideway slides a cleat, each cleat having a recess covered by a plate and carrying a spring-pressed and cam shaped bolt, the sashes being rigidly connected with their respective cleats, so that the sashes and cleats slide in unison as the sashes are adjusted in the ordinary manner of operation. The sashes may be readily removed from the frame without withdrawing screws or nails or other permanent fastening devices.

MATCH SAFE.—Walter W. Pennington, Butte, Montana. This is a device of simple construction designed to limit the removal of matches to the taking of one at a time, thus insuring economy in their use. The safe has a vertical magazine portion with glass end walls and a top cover, and a carriage is mounted to slide across the open lower end of the magazine, the carriage having two transverse channels to receive each a match, whereby a match may be carried out of the magazine of the carriage when the latter is moved in either direction.

DAMPER.—George C. and Norman P. Fraser, Carsonville, Mich. The dampers designed by these inventors are arranged in pairs, in such manner that each pair may be independently operated, the dampers being manipulated to promote a rapid draught or to make the products of combustion pursue a tortuous course through the pipe, somewhat checking the draught and more effectively radiating the heat. The dampers each have an area of less width than the flue, a pinion is connected with each damper, and a rack bar extends between and connects the pinions, the rack bar engaging opposite sides of the pinions to turn the dampers oppositely.

DAMPER REGULATOR.—John R. Hanlon, Pennington, N. J. This invention provides simple means whereby water pressure, operating the draught mechanism of a furnace, may be readily controlled. It comprises a valve for a piped circulating system, the valve casing having a perforated diaphragm, a tubular post adjustable relatively to the casing and engaged by a screw-threaded portion of the valve stem, while a plate valve carried on the inner end of the stem is adapted to close the perforations through the diaphragm, a waste tube or pipe communicating with the interior of the tubular post. The arrangement is such that the draught may be controlled from any part of the building with which suitable connections have been made.

BOOK OR MANUSCRIPT HOLDER.—Elbert D. Hall, 57 Washington Street, Chicago, Ill. This invention relates to that class of holders which are supported on a table and mounted to swing at various positions, to suit the convenience of a reader. The book or manuscript rest consists of longitudinal frame plates whose upper edges are inclined forwardly, a cleat being secured to the front ends of the plates, and the rest being supported on a bar pivoted in lugs at the edge of the table in such manner that it may be moved to very convenient positions with reference to one using the table, while by means of side bars the rest may be elongated either over the top of the table or outward therefrom.

HINGE.—Vespasian V. Hedges, Coffeyville, Kansas. To make a more secure joint between the door and the threshold, for the exclusion of water, air, etc., is the object of this invention, which provides a hinge that will ordinarily carry the door to clear the threshold and swing open, but in closing lowers the door into a notch or rabbet in the threshold. It has two leaves and a pivot pin, one of the leaves having longitudinal movement with respect to the other on the pin, and the latter having a head on its lower end engaging the swinging leaf, while a lever and cam attached to the upper end of the pin engages the fixed leaf.

TRUSS PAD.—George V. House, Mount Vernon, N. Y. This invention relates to pads having elastic bulbs to receive a distending medium, and provides novel features of construction facilitating the convenient inflation of the bulb with air or a liquid, and a graduation of the distention to suit the nature of the rupture to be reduced by the bulb, while also providing for an entire or partial removal of the distending medium, as may be required. A further invention of the same inventor covers novel details as to the manner of holding in place the inflatable pad bulb on a measurably yielding but substantial pad holder upon one end of the truss band, thus greatly improving the device in important particulars.

GAME APPARATUS.—Josua Adler, Salem, Oregon. To teach the rudiments of music while affording amusement, without requiring a knowledge of music on the part of the players, this inventor uses cards on each of which is a musical scale, with the usual lines and notes and the treble or bass signature, numerals indicating the notes, and sets of blocks to be placed above or below the cards. The game is played by trying to build the scale in rotation according to the numerals on the cards, the winning scale being called off by giving the name of the scale and the names of the notes.

COATED SILK UNDERWEAR.—A recently registered trade mark (Kotedalk) covers a new style of goods just introduced by Messrs. Wilmerding & Basset, of New York City, consisting of underwear which has a knitted body portion of cotton and an inner lining of silk, either in the natural state or fleeced. The silk lining renders the garments very soft and they are not liable to irritate the skin of the wearer, while they are designed to be more durable, of lighter weight, and warmer than wool, and also mothproof.

Designs.

JUG.—Henry T. Pope and Benjamin F. Kidder, Fort Payne, Ala. This jug has a horizontally embossed belt, an annular depression or well around its mouth, and two opposite perforated side lugs on the outer wall of the depression.

SCRAPING TOOL.—Sarah M. Cushing, Salem, and Ward O. Perkins, Boston, Mass. This is a simple tool with handle portion and concave scraping edge adapted to clean without damaging the surface of pneumatic bicycle tires.

MOULDED TIRE SECTION.—Jacob A. Lewis and William G. Spiegel, New York City. This design is for a segmental hollow tire, each section having at one end a cylindrical projection and at the other end a solid portion in which is a corresponding cylindrical recess, that the sections may thus be fitted together to form a complete tire.

STOVE.—Ernest C. Cole, Council Bluffs, Iowa. This design is for stove ornamentation which shall make the stove attractive in appearance, the design covering details as to the stove top, legs, ash door, draught plate, etc.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

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(7260) F. C. P. asks: How long should twenty-four cells of gravity battery be in filling four storage batteries of 50 amperes? What would be the best way to connect the gravity cells? I have them connected in series now, but it seems impossible to keep the blue-stone solution high enough or the specific gravity low enough. A. You cannot charge your storage cells in the way you describe. You are using too much voltage and too few amperes. To charge storage cells requires 2·5 volts per cell. You may proceed in one of two ways: 1. The most rapid way—Connect your 4 storage cells in 2 series of 2 each, thus:

2 series of 2 in multiple.

Similarly connect your 24 gravity cells in 6 series of 4 cells each, and charge with them so arranged. If the blue color does not come high enough, a resistance coil will bring it up when put in the circuit. 2. A slower way—Connect the 4 storage cells in 1 series. Connect the 24 gravity cells in 3 series of 8 cells each. If by "50 amperes" you mean 50 ampere hours, by the first method they should charge in 8 to 10 hours, and by the second twice as long is required.

(7261) T. L. B. writes: In SCIENTIFIC AMERICAN SUPPLEMENT, No. 761, of August 2, 1890, I saw a motor constructed by C. D. Parkhurst. Now, I want to construct that motor from his working drawings, but am not quite clear as to the meaning of some of his terms. Therefore, I write to see if you will answer the following queries through your paper. 1. How much wire on each spool of armature and field magnets, i. e., what weight and length on each spool of each magnet, field and armature, how is a shunt motor connected up, also what size of wire should I use on armature and field, and how connect it up to run motor by a battery? A. Each spool will hold about 40 feet of No. 18 B. and S. gage wire for armature and about 142 feet of No. 24 for field, shunt wound. The wire, No. 18, for six spools of armature weighs about 1½ pounds; for the two field spools, No. 24, nearly ½ pound. To connect it as a shunt motor, follow the instructions on middle column of description, page 12161, beginning "The inside end of one spool and the outside end of the next are fastened to one commutator bar," etc. That is what is meant by a shunt or branch. The electricity has two paths. The sizes of wire are No. 18 for 6 armature spools, No. 24 for 2 field spools. See same page of description for this. The motor is intended to be run by a battery and in no other way. If put on a lighting circuit, you will see it go up in smoke, unless the current passes through a resistance consisting of several hundred feet of wire first. This is dependent on the sort of current in the circuit and no definite instruction can be given without full knowledge. 2. What are the soft iron pole pieces fastened to after having one end fastened to the magnets, armature and fields, i. e., what are they fastened to on the armature shaft, or are they fastened at all? A. They are not fastened to anything. They are magnetized by the current through the coils, and cannot be dispensed with. 3. What is their purpose? It seems they can be done away with. You say the commutator may be made of the usual form, with 6 bars, as in Figs. 12 and 11; a good commutator may also be made as described in a previous article upon small motors, the flanged cylinder being cut up into 6 pieces instead of 2. What previous article do you refer to? Can you give me some definite instructions on the commutator, as to thickness of metal, length of commutator and diameter of same? Should it be made of brass? Also, how thick are the brushes? Can you give me some working drawings or tell me in what SCIENTIFIC AMERICAN SUPPLEMENT I can find the building of commutator? A. You will find a good commutator described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, page 9587, third column. In the motor you are building, the commutator bars need not be more than ⅛ inch thick, though they can be more easily fastened if ¼ inch thick. They will not heat with the current they have to carry. They may have any convenient length. They are about 1 inch long in drawing. They should be of copper, though, if more convenient, brass will answer. The brushes are strips of sheet brass or copper, perhaps ¼ inch thick, and set so as to press upon the commutator. 4. Will sheet iron, such as is used to cover storehouses with, do to build up the circular iron plate for armature spools? A. The description says (page 12160, middle column, near top) that stovepipe iron may be used. This means any good quality of soft sheet iron. 5. Does the metal plate on the base have to be brass? Can it not be iron or even steel? A. The base plate is to give stiffness to the base, and prevent warping, as the article states. One metal is about as good as another. To start the motor, connect the two binding posts on the same side to each other by a wire, and arrange battery in series. It does not matter to which side the plus pole is joined. For a good form of battery see SCIENTIFIC AMERICAN SUPPLEMENT, No. 792.

(7262) A. E. T. asks: 1. How can I reduce a current of 110 volts to that of about 5 Bunsen cells? A. A resistance of German silver (preferably) or of iron wire will cut down the current for you. Such a construction as is used for the field resistance boxes of dynamos or for running an arc light in a stereopticon would be convenient. 2. A mucilage that will make a powder stick to skin or leather, so that it will not brush off or crack. A. We doubt whether such a mucilage can be made as you ask for. A mucilage which does not easily crack is made as follows:

Glycerine	4½ parts.
Soft soap	4½ "

Dissolve 1½ parts of salicylic acid in 30 parts of alcohol. Shake thoroughly together and add this to a mucilage made of 140 parts of gum arabic dissolved in about 270 parts of water. The "Scientific American Cyclopedia" gives numerous glues and mucilages, some of which may answer your purpose better than the above. 3. Solution that will amalgamate zinc by dipping it. A. A bath for amalgamating zinc is made as follows: Dissolve 1 part of mercury in 3 parts by weight of aqua regia; which is made by mixing 1 part of nitric acid with 3 parts of hydrochloric acid. To this solution add 3 parts more of hydrochloric acid, and the bath is ready for use.

(7263) F. P., Missouri, asks: 1. What are the necessary properties in a limestone suitable for a plastering lime? Also for a lime that would do for cement. A. The best plaster is made with the purest lime made, from the carbonate of lime rock. For the finishing coat, which requires to have a smooth surface, to be white and set quickly, plaster of Paris (calcined gypsum) is mixed with the lime mortar. 2. Is magnesia a necessary property in lime? Is it necessary in cement? A. Magnesia is not only of no value, but is considered a deleterious element in all kinds of mortar. 3. Is a non-magnesian lime, when ground, as good as any other lime for building purposes? A. Magnesian limestone does not make the best mortar, although much used in the magnesian limestone districts of the United States. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 567, on the deleterious qualities of magnesia in masonry.

(7264) T. M. writes: 1. Please tell me through your paper, in using a 110 volt system, what size wire I should use to bring the current down to about 150 amperes at 60 volts, as I am an amateur in electrical matters, and would like to know. A. If the wire is to be open to the air, No. 1 A. W. G. will carry 150 amperes; if it is to be shut away from the air, No. 00 should be used. Of this wire you will need 5,912 feet. For a drop of 60 volts, measure off ⅛ of the wire, or 3,235 feet, and use the rest as a resistance box is used. 2. Also please tell what resistance and amperes on a 60 volt system, using a storage battery, so the voltage is about 45 and 150 amperes. If this is not plain enough, please let me know, as I am not up in electrical matters. A. To obtain 45 volts with a storage battery, 23 cells in series are required. The type "G" of the chloride accumulator, 17 plates in a cell, will give 160 amperes for 10 hours.

(7265) B. B. asks: 1. Can you make the field magnet ring for the dynamo described in your paper September 11, 1897? I do not want the holes bored in it—just the plain ring, made according to the directions given. A. This can be done by some machine shop in your part of the country far cheaper than it could be done in New York and sent out. The ring should be of wrought iron. While a cast iron ring will work, it is not so effective. 2. What will it cost to get the toothed armature made? A. The cost of having this toothed armature made will of course vary according to the value of the time of the maker. It should not take over two hours. The cost of the thin iron should come within thirty or forty cents. 3. Can I use a ten segment commutator instead of the rings? A. This machine is not intended for a direct current generator, owing to the number of poles in the field. Therefore, a ten-segment commutator would not be adapted to the purpose. 4. I do not understand much about it, but, from what I have read, I inferred that when ring commutators are used, the dynamos give alternating currents and when segment ones are used we get continuous currents. Is this so? A. Your inference in regard to ring and segment commutators is correct. With plain sliding rings, dynamos give alternating currents, when the fields are separately excited. With segment commutators the alternating current is rectified, producing a continuous current. 5. If the above is true, if I use a segment commutator on the dynamo, will I get a continuous current? A. The conversion of this machine to a direct current dynamo is not advisable.

(7266) J. C. P. writes: My 90° hand feed arc lamp in stereopticon current, 15 amperes at 60 volts, cored carbons, lower one biggest, troubles me by "growing" horns on the lower carbons, short continuous arc and varying intensity. Why? How avoided? A. The

growth of the negative carbon is in general due to an excess of current. Additional resistance in the circuit of the lamp will remedy it.

(7267) H. A. C. says: Will you kindly publish in your valuable paper a recipe for tempering wood cutting tools in oil? A. Wood cutting tools are usually made somewhat softer and with more of a spring temper than the thicker edge of metal cutting tools. The process is the same for both, but the temper is drawn lower or to a bluish tint. For wood cutting tools hardened in oil a slow fire should be used, so as not to burn the corners and edges by overheating. Heat to a cherry red and quickly plunge, edge first, in the oil bath. While the thick part of the tool is still hot, place it over the fire and slowly heat until the oil takes fire, then plunge again in the oil bath or water. The bluing process of tempering is much used, and is done by cleaning the surface of the hardened part of the tool with emory paper and then heating by contact with a piece of red hot iron just back of the cutting edge. When the color has reached the blue tint, plunge it in water.

(7268) S. A. S. asks: 1. If a cubic inch of water, in passing over a hot metallic surface, absorbs a certain amount of heat, how many cubic inches of air will have to pass over to absorb the same amount in the same time? A. Water will take up about four times as much heat as air under the same circumstances, the air to be free, that is, not under pressure except atmospheric pressure. 2. What I wish to get at in the above question is really the proportion between the conductivity of air and water. A. This is an entirely different question, though apparently not meant to be. The experiments are not very conclusive as to the relative conductivity of air and water, but it may be stated somewhat roughly that the conductivity of air is from $\frac{1}{25}$ to $\frac{1}{30}$ that of water.

(7269) R. W. S. asks how to make a copying and enlarging camera and desires to know how a suitable combination of spectacle lenses can be made to have only 4 inches focus, yet of sufficient covering power to enlarge a 4×5 negative to an 8×10, and where and what stops should be used? A. A concavo-convex single spectacle lens an inch and a half in diameter can be used with a stop $\frac{1}{16}$ of an inch in diameter located in front of the lens about one inch. The focus of the lens should not be less than six inches. See SUPPLEMENT, No. 1031, for a reducing and enlarging camera.

(7270) F. F. asks (1) if it is practical to build the dynamo described in your SUPPLEMENT, No 600, three-fourths the given dimensions. If so, what changes are necessary in the size and amount of wire, and what will be its output? A. The dynamo of SUPPLEMENT, No. 600, can be built three-fourths as large as the given dimensions. Use No. 23 A. W. G. for the armature and No. 21 for the field. Wind the same number of coils and turns in each as called for in the original design. 2. What power will it have if run as a motor, and how many cells of Partz gravity battery will be required to run it? A. It will give about ¼ horse power as a motor. It would not be economical to drive it with gravity cells. 3. Is it possible to run such a motor on an incandescent alternating circuit? A. A direct current motor cannot be run on an alternating circuit.

(7271) A. J. P. writes: In reference to the answer given to E. E. S. in Notes and Queries, question No. 7242, in the SCIENTIFIC AMERICAN for November 27, I would respectfully call your attention to the fact that a change in the strength of the needle would not change the value of one ampere on the scale. To quote W. E. Ayrton in his "Practical Electricity:" "The deflection produced by a given current passing through a tangent galvanometer is not altered by varying the strength of the magnetic needle. . . . For altering the strength of the needle alters the deflecting and controlling forces in exactly the same proportion, so that the direction of the resultant of these two forces remains unchanged. A. A. J. P. is correct. It is a well known fact that the law of the current for the tangent galvanometer is $C = \frac{Hr}{2\pi u} \tan a$ —a formula which contains no factor dependent on the needle. In other words, the strength of the needle is not involved. The only condition affecting the needle is that it should not be longer than from one-tenth to one-twelfth of r, the radius of the coil.

NEW BOOKS, ETC.

LIGHT: VISIBLE AND INVISIBLE. A series of lectures delivered at the Royal Institution of Great Britain, at Christmas, 1896. By Silvanus P. Thompson. New York: The Macmillan Company. London: Macmillan & Company, Limited. 1897. Pp. 294. Price $1.50.

This is an extremely valuable work, giving interesting experiments, many of which appear to be new. Many of the ideas which must be grasped in considering light, for example the polarization of light, are popularly supposed to be extremely difficult; whereas the difficulty lies in the ideas themselves as much as in the language in which they are generally set forth. In an experience lasting over a good many years, the author has found that the main points in the phenomena of polarization are quite easily grasped by persons of ordinary intelligence—even by children—provided they are presented in a modern way devoid of pedantic terms and illustrated by appropriate models. The lectures are as follows: Light and Shadows; The Visible Spectrum and the Eye; Polarization of Light; The Invisible Spectrum (Ultra Violet Part); The Invisible Spectrum (Infra Red Part); Roentgen Light. The few pages devoted to magic mirrors are most interesting, as is also the chapter on Roentgen light. The collection of Roentgen photographs is interesting. In the appendix to the last lecture a number of other kinds of invisible light are considered. They are Becquerel's rays; phosphorus light; light of glow worms; Wiedemann's rays, paracathodic rays; diacathodic rays, and Goldstein's rays. It will be seen from what has been said that the book is without doubt the most thoroughly up to date treatise upon the subject of light, and the great reputation of Prof. Thompson is the guarantee of scientific accuracy of statements.

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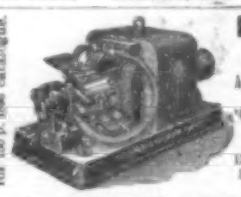

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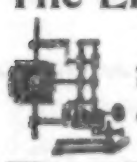

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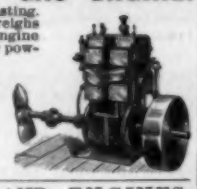

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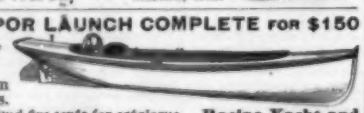

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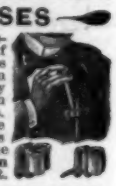

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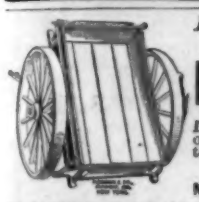

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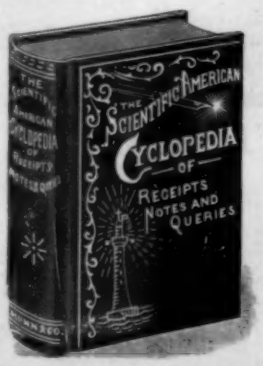

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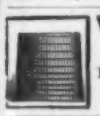

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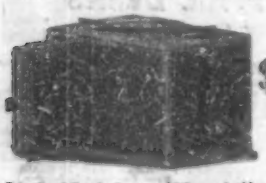

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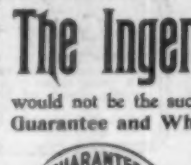
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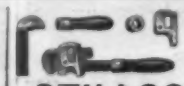

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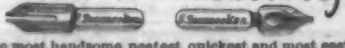

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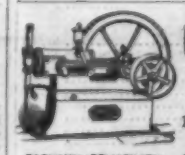

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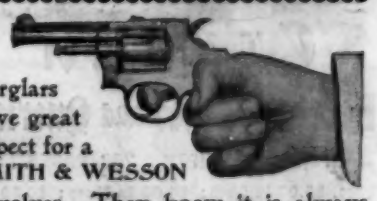

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